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INSTITUTE OF THE AERONAUTICAL SCIENCES

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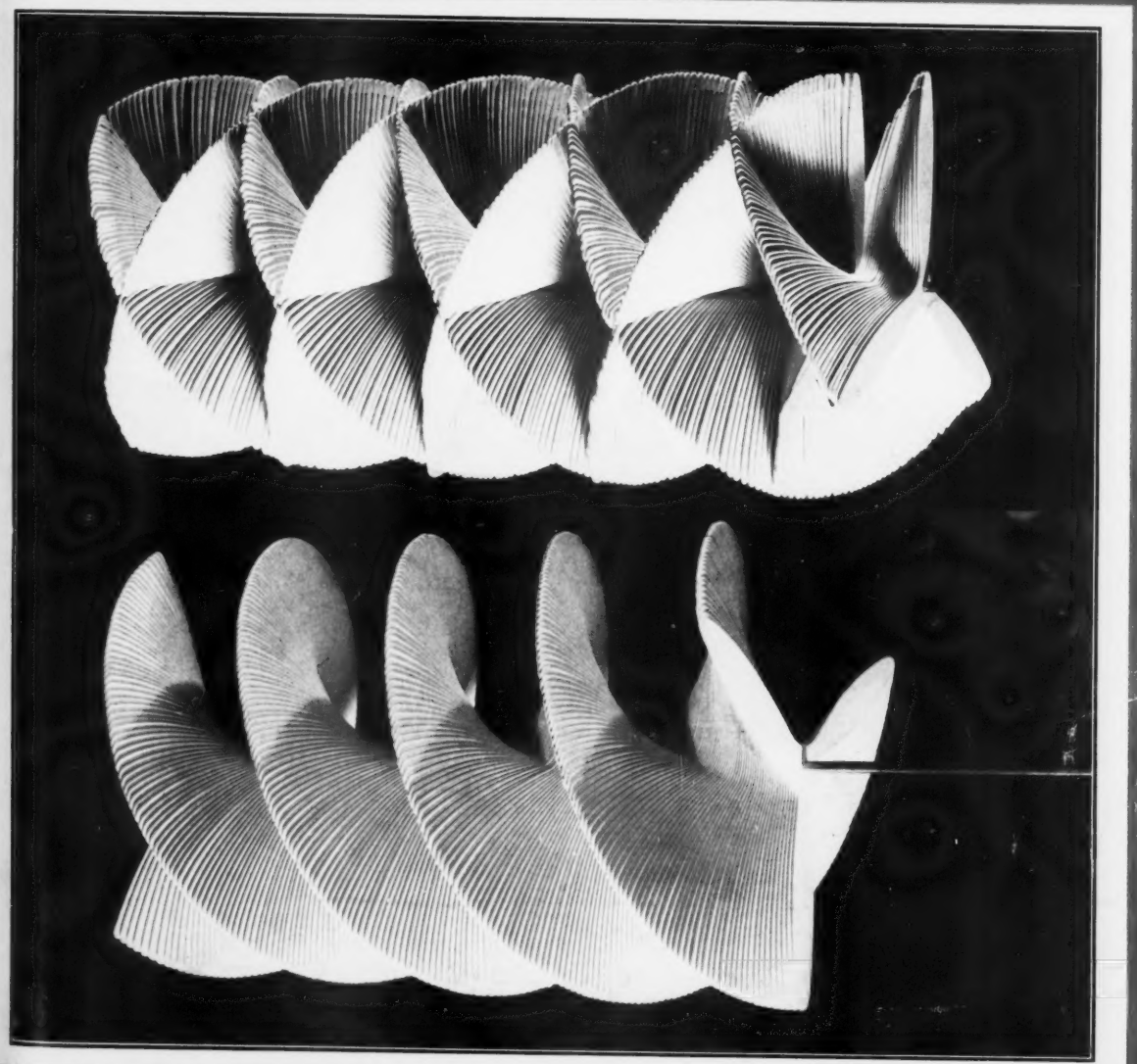

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In studying the design characteristics of aircraft propellers, miniature cardboard propellers were used to trace the patterns developed by the blades in advancing through the air. The top photograph shows the pattern created by a six-bladed dual-rotation propeller. The lower photograph shows the pattern traced by a three-bladed Curtiss electric fully automatic propeller set in full pitch.

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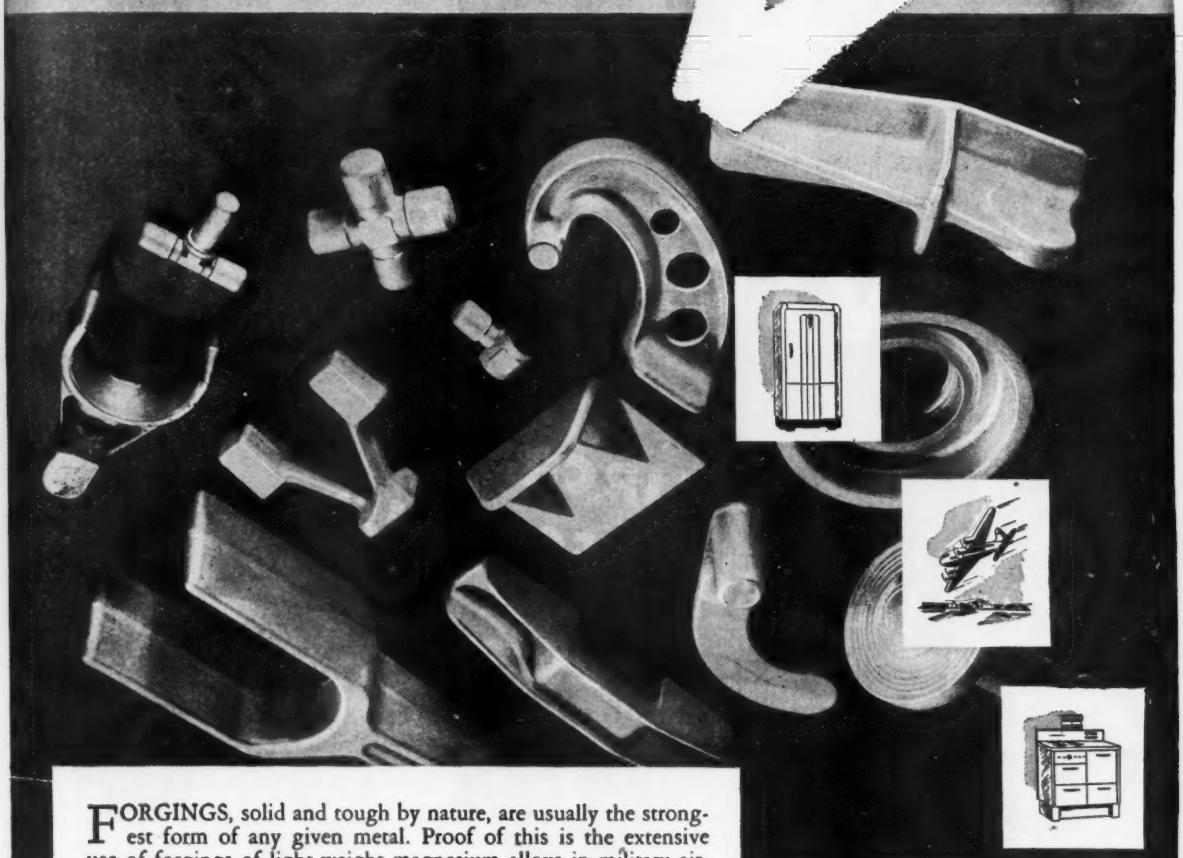

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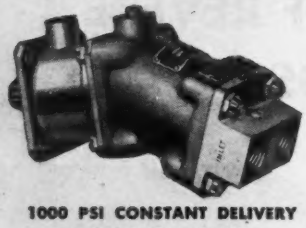

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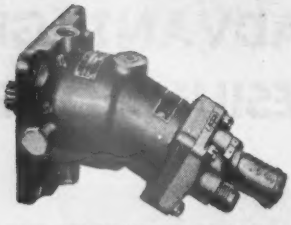

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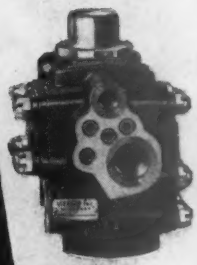

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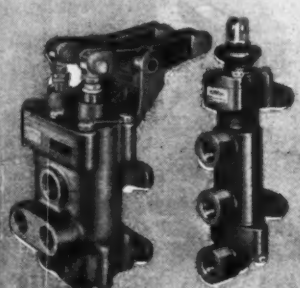

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Control Surface Spring Tabs

FRANK W. DAVIS*

Consolidated Vultee Aircraft Corporation

ABSTRACT

Recent trends toward larger airplanes and higher speeds necessitate the use of some simple means for achieving satisfactory control characteristics. Calculations and flight tests indicate that spring tabs, devices that provide a decrease in control hinge moments proportional to the force applied by the pilot, offer a solution to the problem.

The prevention of flutter and practical construction must receive the main consideration in design. General rules are helpful in designing to prevent flutter, but each application of spring tabs should be thoroughly analyzed. It is possible to improve stick-free static longitudinal stability by proper rigging of an elevator spring tab, and in designing spring tabs, several rules may prove to be helpful: (1) design to prevent flutter, (2) keep the system free of friction, and (3) use the spring tab only to obtain refinements in control characteristics, not as a cure-all.

INTRODUCTION

DURING THE PAST FEW YEARS there has been considerable speculation as to the advantages of using spring tabs on airplanes for the purpose of providing control forces of desirable magnitude under all conditions.

This paper will discuss the subject with a view to passing on some of the lessons that have been learned by Consolidated Vultee since their first application of spring tabs early in 1942.

NECESSITY FOR DEVELOPING A MEANS OF REDUCING CONTROL FORCES

With the advent of the present trend toward airplanes of larger dimensions and weight, higher powers, and higher speeds, the problem of obtaining satisfactory controllability by direct manual operation of the controls has become more difficult.

In can be shown that for geometrically similar airplanes the control force varies as the cube of the physical dimensions and as the square of the velocity, assuming the same angle of attack and control surface deflection. That is, if the size of an airplane were doubled, the rudder force required to produce a given angle of yaw, the elevator force required to produce a given acceleration, or the aileron force required to produce a given helix angle at the wing tip would be increased by eight times.

If the speed were then doubled, the aileron force and rudder force would be multiplied by an additional factor of 4, making a total increase of 32 times that of the original airplane. The elevator force gradient in pounds per g would theoretically remain unchanged by the speed change. If the same rate of roll were desired rather than the same helix angle, another factor of approximately 2 would be introduced and the aileron force required would be 64 times larger than for the airplane of half the speed and size.

For a 500-m.p.h. airplane of approximately twice the span of most present-day fighters, approximately 98 per cent of the hinge moment of a plain aileron would have to be balanced out in order to meet present fighter requirements.

The consequences of this trend are well exemplified by the history of one of the earlier heavy dive bombers. Attempts to secure satisfactory stability and control characteristics by use of simple aerodynamic balance and geared tabs consumed 98 hours of flight testing, involving 119 modifications, and the results were even then not entirely satisfactory.

Such a process is highly educational but is so uneconomical of time and money that some better method of obtaining satisfactory control characteristics appears to be mandatory if airplanes are to be developed at a reasonable cost and reasonably quickly.

It can also be seen that an airplane requiring 95 to 100 per cent of perfect balance on control surfaces will be subject to wide variations in handling characteristics because of production tolerances. This situation was found to exist in the production dive bomber mentioned previously. For example, an elevator control force gradient of 12 lbs. per g was desired. The prototype actually ran about 15 lbs. per g, but some of the production models ran as high as 25 lbs. per g.

This situation points out the necessity for a device which, in addition to providing quick adjustment of control forces during the prototype development, will be insensitive to normal production tolerances.

PRINCIPLE OF OPERATION OF SPRING BOOST TAB

Calculations and flight tests indicate that the spring tab provides a satisfactory solution to the above problems.

A spring tab may be defined as a control surface tab whose deflection is primarily a function of the hinge moment occurring at the control surface. Its direction of movement is at all times such as to decrease the absolute value of the control surface hinge moment. Contrary to conventional geared boost tabs, the movement of the spring tab is independent of the control surface deflection, except insofar as such deflections cause changes in stick force.

Fig. 1 may help to illustrate this principle. Whenever a force is applied at the stick or wheel, it is resisted by the hinge moment of the control surface. This resistance causes the control horn to rotate with respect to the surface and deflect the torsion spring. The relative motion of the horn with respect to the surface is translated into angular motion of the tab.

It can be seen then that the motion of the tab is always in a direction tending to help the pilot and the help it provides is proportional to the force the pilot applies.

SPRING BOOST TAB DESIGN

The actual aerodynamic design of a spring tab is strongly influenced by several practical considerations.

First, "feel" on the ground and in the air is improved by a stiff spring of small deflection. Approximately 5° of windup appears to be the maximum practical limit. Second, in installations such as shown in Fig. 1, the maximum length of arm which can be housed in the surface and the minimum length of tab actuating horn determine a maximum boost ratio that can be used. This is of the order of three to one, giving a maximum tab deflection of approximately 15°, which is also about the limit of good aerodynamic effectiveness. Third, the tab should be as small as possible in order to reduce weight and to make easier the problem of preventing flutter. The use of a reasonable amount of aerodynamic balance on the surface will make this possible. Other practical considerations are primarily those of preventing flutter.

Theoretical methods for determining tab chord, span, deflection, and spring constant have recently been published in certain N.A.C.A. reports. These methods are similar to those used by

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* Development Engineering Group, Vultee Field Division.

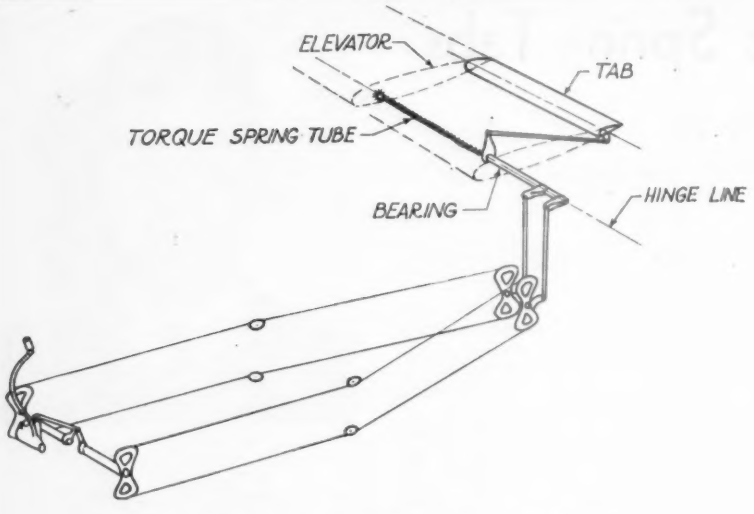

Fig. 1. Sketch showing spring boost tab used on elevator.

Consolidated Vultee and can be used in conjunction with the above practical considerations to arrive at a tab design that will give the desired results.

Flutter

A study of early applications of spring tabs reveals that flutter was encountered in most cases. Further examination shows, however, that mass balance was not generally applied. Calculations indicate that flutter can be avoided by proper design and use of mass balance.

The procedure used in flutter analysis of spring tab systems is essentially identical with that followed in all flutter analyses. Briefly, it consists of:

(a) Writing the differential equations of motion of the airplane components between which inertia, elastic, and aerodynamic interaction can take place when a small disturbance from equilibrium is given to one or more of these components, and

(b) Solving these equations of motion for a given set of conditions corresponding to a particular air speed to determine the degree of stability or instability existing against flutter. This process, repeated for a sufficient number of air speeds, leads to a plot of the flutter-stability vs. air speed covering the entire speed range of the airplane.

The results of calculations are considered in the light of the degree of applicability of the assumptions made regarding the particular case in question. In fact, it is a good practice to investigate the results of varying a number of the important parameters entering the calculation over a range of values conforming to the probable accuracy of the assumptions and the data entering the calculations.

Experiences with spring tab flutter calculations indicate that several general rules can be stated in regard to preventing this type of flutter. These are:

(a) The reduction of the tab size to an absolute minimum consistent with control requirements. In this regard, use of the spring tab to do the complete job of balancing the main control surface hinge moment is not recommended as it leads to an unnecessarily large tab from the flutter standpoint.

(b) The achievement of a minimum of play and flexibility in the operating control system and supporting structure, including main control surface ribs.

(c) The use of as high a tab spring constant as possible.

(d) The attainment of proper static and dynamic balance with the smallest possible tab moment of inertia. This is especially important as theoretical results indicate that the indiscriminate addition of balance weight to tabs to achieve static balance without due regard to the effects of this balance weight in increasing the tab moment of inertia can actually result in lowered flutter speeds. Thus, external balance arms that do not lie in the plane of the tab are to be avoided as the moment of inertia of the tab is increased disproportionately to the degree of static balance achieved.

(e) In certain applications the gear ratio of the tab, i.e., the ratio of the tab deflection to the spring deflection, in a system such as in Fig. 1, will define a certain maximum distance forward of the tab hinge line at which the tab balance weight can be located. More forward locations will be detrimental from the flutter standpoint. From this point of view, small gear ratios are beneficial.

(f) Finally, unless previous experience in the use of such tabs is available, a thorough flutter analysis should be conducted in all new applications in order to assure safety and maximum efficiency of design.

One case of flutter was encountered during routine production testing of the dive bomber previously mentioned. The flutter appeared to occur in the tab elevator system only and was nondestructive. The tab involved was examined and was found to be improperly mass-balanced. The balance was corrected, but flutter occurred again, only at 423 m.p.h. instead of 378 m.p.h. as in the first case. From the characteristics of the flutter, it was suspected that some aerodynamic flow instability occurring at the tab was coupling with the spring deflection at the proper frequency to produce the flutter. The tab was found to be slightly convex in section. This was changed to a slight concavity and the same tab was reinstalled. No flutter occurred with this condition up to the limit dive speed of the airplane, and no flutter has occurred on any subsequent installations.

Weight

The total cost in weight of the spring tab on an airplane of approximately 20,000 lbs. is 14.0 lbs. for the elevator, 8.00 lbs. for the rudder, and 14.0 lbs. for the ailerons. It is felt that this compares favorably with other means of accomplishing the same end.

Application to Recent Designs

The application of spring tabs proves to be extremely simple mechanically. The schematic diagram previously shown is the system that has actually been successfully applied to several airplanes. No special maintenance has been necessary.

Flight Test Results

In order to illustrate the benefits that can be realized by use of the spring tabs, the flight test histories of three airplanes will be used.

First Application

The first was a single-engined dive bomber of approximately 13,000 lbs. The discouraging attempts to obtain satisfactory handling characteristics by use of aerodynamic balance and simple boost tabs have already been mentioned.

It is agreed by most authorities that a large dive bomber poses serious requirements for stability and control. The reason lies not alone in size, but in the fact that the magnitude and rapidity of speed changes are large, center of gravity travel is large, and the use of dive brakes, bomb doors, and other such equipment may seriously alter trim, control, or stability. Coupled with this situation is the absolute necessity for light, sensitive, but well-damped control during dives in order to obtain accuracy, and the requirement that the resetting of trim tabs should not be necessary during a dive.

The spring tab was first applied to the rudder. The rudder was chosen because the problem of directional trim change during the dive was serious, and also because it was known that the consequences of rudder failure, if flutter occurred, would probably not mean the

loss of the airplane. A device for locking out the spring tab was also provided.

The results of the first flight with this arrangement were extremely encouraging. The whole speed range of the airplane was covered without any sign of flutter, and rudder force remained light up to the limit diving speed. It was possible to trim at speed for best climb with full power and then dive to terminal velocity with dive brakes open without any change in trim that could not be easily handled without the use of the trim tab.

After that, the mechanism was redesigned for lightness and simplicity and the spring constant adjusted to provide further refinement of forces.

The application to the elevator was then made with equally encouraging results. It was possible to obtain the desired stick force of 12 lbs. per g and to hold it within approximately ± 1 lb. per g on subsequent production airplanes.

The theoretical calculation had shown that the force gradient in pounds per g would decrease as speed increased. This was found to be not true. The force gradient remained practically independent of speed from 200 to 400 m.p.h.

This fortunate phenomenon occurred because the fabric-covered elevators were vented in such a way that the deformation at high speeds caused an increase in hinge moment which just balanced the decrease due to the spring tab. It has been possible to arrive at the same situation on subsequent applications.

Second Application

The second application of spring tabs was on an unconventionally arranged fighter weighing about 19,000 lbs. Satisfactory characteristics were obtained on the rudder and elevator after 8 hours and twelve configuration changes. Aileron characteristics were extremely poor without spring tabs. By use of spring tabs their characteristics were greatly improved, but not to the extent desired.

Third Application

The most recent application of spring tabs at Consolidated Vultee was on a single-engined attack bomber of approximately 20,000 lbs. It was desired to meet fighter requirements on handling characteristics throughout a c.g. travel of 10 per cent. Fighter characteristics were achieved on longitudinal and directional control after 14 hours of flight testing, involving 16 configuration changes, all of minor nature.

Elevator control force was 7 lbs. per g at maximum rearward c.g. and 11 lbs. per g at maximum forward c.g., a phenomenally small change in gradient with change in c.g. position.

The result of the application to the ailerons was similar to that just related on the fighter.

In both instances where spring tabs were applied to ailerons, considerable improvement was obtained, but in neither case did ideal characteristics result. However, in both cases aileron characteristics were extremely bad without the spring tabs and the tabs were added as a last resort. In general, the aileron forces were markedly lightened at high speeds, but not much affected at low speeds. It is felt that had satisfactory low-speed characteristics existed on the ailerons to which the tabs were applied, the desired overall characteristics might have been obtained.

One difficulty in the application of spring tabs to ailerons is that the ailerons are tied together so that the upfloating tendency of each aileron is balanced against the other. When springs are introduced at the ailerons in a manner similar to the elevator, as shown on the previous schematic diagram, each aileron is allowed to float up against the spring. At high speeds and high angles of attack, the spring is deflected against its stop, thus limiting the tab action to one direction only. Although the upfloating ailerons undoubtedly increase the drag to some extent, flight tests have failed to reveal any appreciable loss in speed when stiff springs are used. There is one advantage in that wing loads at high angle of attack are somewhat relieved by the upfloating ailerons.

Effect of Spring Boost Tab on Longitudinal Stability

A rather interesting application of the spring tab to elevator free static longitudinal stability has also been made.

The tab was rigged to ride up approximately 7° with no load on the spring. With this rigging, the tab tends to trail at some slight up-angle at any given air speed. If the air speed is decreased, the tab tends to trail higher, thus forcing the elevator down, tending to return the airplane to the original trim speed. If the air speed is increased, the tab trails at a lower angle, forcing the elevator up, thereby tending to return the airplane to its original trim speed. An increase in stick-free static longitudinal stability of approximately 6 per cent was actually obtained by this method.

This idea will work only if friction in the tab system and in the control system is extremely low. As a matter of fact, low friction is absolutely essential to the successful application of spring tabs as outlined in this paper. It is conceivable that by using preloaded springs, considerable friction could be tolerated. However, in any case, friction should be kept as low as possible.

Conclusions

A few rules will be stated which should be followed by anyone interested in using spring tabs.

(1) Design to prevent flutter.
   (a) Keep the moment of inertia of the tab about the hinge line as low as possible.
   (b) Provide a small amount of excess mass balance to take care of dirt or ice accumulating on the tab.
   (c) Keep spring constants high.
   (d) Keep all supporting and actuating structure stiff and free from play.

(2) Keep friction in the entire control system to an absolute minimum.

(3) Use the spring tab only to obtain refinement in characteristics, not as a cure-all for a basically poor control surface.

(4) Keep it simple.

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The Field of Marker Light Guidance in Airplane Landing

H. J. CORY PEARSON* and ARTHUR J. SWEET†

Civil Aeronautics Administration

Introduction

One of the two major deterrents to general public acceptance of commercial passenger travel by air is inadequate dependability of schedule maintenance.‡ This inadequate dependability of schedule maintenance is due to lack of dependable facilities for safe landing under substantially any and all visibility conditions, not to lack of facilities for safe take-off or to lack of facilities for safe travel on the airways. The possibilities and limitations of all types of landing guidance, together with the associated subject of the control of landing traffic, should therefore be of keen interest to everyone concerned with the development of aeronautics.

Types of Landing Guidance

There are three types of landing guidance—namely, object visibility guidance, marker light guidance, and radio guidance.

Object Visibility Guidance

Object visibility guidance is the type of guidance to which man has become thoroughly habituated during the millenniums of his evolutionary development. It therefore is, and will remain, the guidance preferred by the pilot. It requires (a) illumination of that portion of the landscape with which the pilot is concerned and (b) an atmosphere sufficiently clear so that the illuminated landscape is visible to the pilot. Object visibility guidance is the guidance that has heretofore been chiefly depended upon for day landings and which, in somewhat lesser degree, will continue to be so depended upon.

Marker Light Guidance

Marker light guidance eliminates the requirement of illuminating the landscape and involves only the single requirement of an atmosphere sufficiently clear so that the marker light is visible to the pilot. Moreover, it is practicable to provide marker lights that will be visible under atmospheric conditions where illuminated objects would not be visible.

The interpretation of object visibility guidance is learned in infancy and is subconscious in the adult. In contradistinction, the interpretation of marker light guidance has to be learned by the pilot through landing experience. Once so learned, it becomes no less subconscious than object visibility guidance and is depended upon by the pilot with equal confidence and with equal degree of safety.

Radio Landing Guidance

Radio landing guidance is, of course, independent of visibility conditions and, in its most perfected form, is independent of atmospheric conditions of whatever sort. Indeed, at altitudes above, say, 200 ft., radio landing guidance, when provided in accordance with best present-day knowledge, is a close approximation to ideal guidance. It is reasonably satisfactory down to an altitude of, say, 50 ft. In an increasing degree, however, as contact is closely approached, radio guidance is characterized by two limitations.

(1) As contact is closely approached, a small departure from the designed landing pathway produces as great a deflection of the glide-path needle as does a much greater departure from pathway at a considerable distance from contact. Because of the hazard inherent in his situation, the pilot is impelled to correct for such departure, and in so doing he is inclined to overcorrect and produce a considerable deflection of the guiding needle in the opposite direction. This oversensitivity produces a serious mental hazard. Means have been developed and employed to correct for this limitation, but the inherent range in sensitivity is so great that any correction that is adequate for positions near contact involves unpermissible undersensitivity at positions remote from contact.

(2) There is nothing in ancestral experience to afford confidence in instrumental guidance, and even extended experience of the individual with such guidance fails to remove a tense feeling of insecurity as contact is closely approached. When accompanied by a copilot who is relying upon object visibility guidance or marker light guidance to act as a stand-by monitor, an experienced pilot can land solely by radio guidance without prohibitive nervous strain. The same pilot, unless of unusually imperturbable temperament, makes his landing under serious mental hazard when visibility conditions prevent the copilot from acting as a visibility-guided monitor.

It is significant to observe that both object visibility guidance and marker light guidance disclose the pathway ahead, thereby affording a comforting sense of security. Radio guidance, on the contrary, looks only backward, not forward; for in the split second that is required by the pilot to react to his instrument reading, the fast-moving airplane has traveled to some distance beyond the point to which the reading applied. This parallels the human experience of feeling one's way in inky blackness through well-known surroundings; one can orient himself with respect to the pathway ahead, yet he proceeds along that pathway with a strong sense of insecurity.

Advantages of Object and Marker Light Guidance

Unlike radio guidance, both object visibility and marker light guidance improve as contact is closely approached. For example, marker lights are capable of providing completely safe guidance for the entire landing operation, when made by night, only in atmospheres corresponding to a daylight object visibility not less than $1/2$ mile—that is, a transmissivity not lower than 78 per cent per pentecontameter;** yet marker lights, when employed in night landings, are capable of providing safe guidance throughout the last 150 ft. of the landing operation in atmospheres corresponding to a daylight object visibility as low as 230 ft.—that is, a transmissivity as low as 9 per cent per pentecontameter.

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† Deceased March 7, 1945. Formerly Associate Airport Engineer, Technical Development Division.

‡ This statement is made with respect to the early postwar situation in the United States.

** The transmission per unit distance of 50 m. (pentecontameter) of atmosphere affords a particularly convenient unit in which to measure transmissivity. "Clear" in the International Visibility Scale corresponds to a transmissivity range of 98 to 99 per cent per pentecontameter; "Dense Fog," to a transmissivity below 2 per cent per pentecontameter. In other words, the per-pentecontameter unit makes it possible to express transmissivity as a simple percentage without material impropriety in the significance normally attached to percentage values.

Seventy-eight per cent transmissivity (see text above) is classified as "Light Fog," which corresponds to a transmissivity range of 68 to 82 per cent per pentecontameter. Six per cent transmissivity (see text above) is classified as "Thick Fog," which corresponds to a transmissivity range of 2 to 38 per cent per pentacontameter.

TABLE I

Landing	Guidance	Visibility Conditions as Measured by—Object Visibility by Day	Transmissivity per Pentecontameter	International Visibility Scale
By day	Object visibility	1,000 ft.	53%	Moderate Fog
By day	Object visibility plus marker light	500 ft.	28%	Near upper limit of Thick Fog
By night	Marker light	250 ft.	8%	Near lower limit of Thick Fog

These considerations justify the conclusion that object visibility guidance by day, marker light guidance by night,† are, respectively, the appropriate types of guidance in the final stage of the landing operation whose earlier stages are radio-guided.

This conclusion is likely to be challenged by the radio enthusiast whose pardonable pride in the achievements of his science makes him unwilling to acknowledge any limitations. In reply to such challenge, it must in fairness be recognized that radio landing guidance will undoubtedly be developed to the point where the final stage of the landing could safely be made in routine operation solely by instruments—perhaps even automatically. The true rebuttal of the challenge lies in the incontrovertible fact that, even though radio guidance be safe, object visibility guidance by day and marker light guidance by night will, if equally safe, be strongly preferred by the pilot. The error of the radio enthusiast arises from his failure to realize that object visibility and marker lights afford safe guidance for the final stage of the landing operation under visibility conditions far more adverse than those that limit their respective adequacy for the complete landing operation.

Limiting Visibility Conditions

The limiting visibility conditions under which object visibility guidance and marker light guidance are fully adequate for safety in the final stage of the landing operation are set forth in Table 1. These values are conservative and might defensibly be lowered somewhat.

It is true that present marker light practice does not provide adequate guidance for safe landing under the limiting visibility conditions set forth in the above table. Incident to a 2-year comprehensive study of the subject, the authors have developed improved marker light practice that will provide such adequate guidance. At present, this claim of adequacy can be supported only by technical data. Service experience with the proposed practice will be obtained as soon as a demonstration installation, now being planned, can be provided.

Visibility conditions under which the final stage of the landing operation may safely be performed either by object visibility guidance or by marker light guidance will be present in at least 99½ per cent of the landing operations of continental United States exclusive of Alaska, probably in about 99¾ per cent of such landing operations. It is believed that the latter figure provides an acceptable degree of dependability in schedule maintenance. To the authors it therefore seems to be sound technology to rely upon object visibility guidance or marker light guidance or both for the final stage of the landing operation, relying upon radio guidance only in emergency situations. Even in such emergency situations, marker light guidance will provide a valuable supplementary service if there is a copilot to act as monitor, utilizing such guidance help as the marker lights afford.

† In day landings at low visibilities, marker light guidance is a useful supplement of object visibility guidance.

Landing Capacity

The foregoing analysis takes account only of considerations of safety and comfort. There are, however, pertinent considerations of landing capacity which dictate reliance upon radio guidance in the earlier stages of the landing operation under visibility conditions where object visibility guidance or marker light guidance would be adequate for safety and comfort. These considerations here deserve attention.

Railway experience has conclusively established the principle that, for any given type of commercial transportation, the entire passenger traffic of a locality should be handled through a single station. Violation of this principle involves public dissatisfaction and limitation of patronage.

It is exceedingly important, therefore, that design and practice be such as to permit a single airport to handle the entire commercial passenger traffic of its community. Reasonably anticipating the future of commercial air travel, this presents a problem of considerable difficulty.

Without material public inconvenience, private flying and commodity transportation can be excluded from the airport serving commercial passenger traffic. This materially eases the problem, but it does not solve it.

Runways may be multiplied, but two is the limit for simultaneous effective use under the conventional grid system of runway layout; six, under the tangential system. Even six runways in simultaneous use cannot handle the anticipated peak-hour traffic of New York and Chicago unless the rate of landing and take-off is greatly speeded up over present practice and unless that rate is developed to its ultimate possibilities.

In short, the problem is one of developing maximum *runway* capacity, and within a few years this will become an extremely urgent problem.

For the type of airplane to be anticipated in major passenger transport, exclusive of transoceanic and transcontinental flying, an interval of approximately 50 sec. after the landing airplane crosses the runway threshold must be allowed before the next airplane in the traffic stream can safely be permitted to cross the threshold in landing. But if the next airplane does not reach the threshold at the very instant when it could safely cross and land, the runway is momentarily idle and landing capacity is reduced. Attainment of maximum runway capacity therefore requires regimentation of the traffic stream, and this regimentation must be performed at the beginning of the landing operation, approximately 10 miles in travel distance before the threshold is reached. After regimentation, any variations in speed or pathway in traveling the 10 miles to the threshold must be allowed for, so that successive airplanes shall not arrive at the threshold at an interval of less than 50 sec. Even assuming a variation as low as ±4 per cent—a variation lower than is today attainable, though it may reasonably be anticipated—such variation adds 30 sec. to the regimentation interval. Thus it will be evident that maximizing runway capacity largely hinges on minimizing this variation.

It is impossible to adhere closely to a standardized landing pathway unless that pathway be marked by radio guidance. Hence, maximization of runway capacity requires radio guidance not merely on the final leg, as at present, but for the earlier stages of the landing operation, and that guidance will be required even when ceiling and visibility are unlimited. It can be dispensed with only when traffic density is far below runway capacity, and then only in daytime atmospheres not thicker than 1-mile object visibility and in nighttime atmospheres not thicker than would afford a daytime object visibility of ½ mile.

Summary

(1a) Object visibility guidance is preferable to all other types of guidance for all portions of the landing operation provided *all* of the following conditions are present: (a) daylight, (b) light or moderate traffic,* and (c) atmosphere sufficiently clear to afford 1-mile visibility ($T = 88^1/_2$ per cent).

(1b) Object visibility guidance is preferable to all other types of guidance as contact is approached provided *both* of the following conditions are present: (a) daylight and (b) ground stratum of atmosphere sufficiently clear to afford 1,000 ft. visibility ($T = 53$ per cent).

(2a) Marker light guidance, though inferior to radio guidance in the earlier stages of the landing operation, is adequate for all portions of the landing operation provided *all* of the following

* Less than (say) 15 landings per hour.

(*Continued on page 19*)

Lockheed Constellation Hydraulic Mock-Up Tests

B. A. ROSE*

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ABSTRACT

The Lockheed Constellation hydraulic system was mocked up in a full-scale replica of the actual airplane installation. A comprehensive test and development program was pursued in which all of the airplane equipment of this system was subjected to aerodynamic loads simulating the most severe flight conditions.

The flight station was equipped with airplane controls, throttles, tachometers, automatic pilot, and all hydraulic accessories. Four automobile engines were substituted for the airplane engines and supplied power for the operation of the hydraulic pumps. The landing gears, booster surface control assemblies, tail bumper, hydraulic cylinders, etc., were installed and operated on the mock-up. Appropriate devices were provided for measuring control forces, surface positions, control stick positions, developed surface hinge moments, fluid pressures, temperatures, etc.

The complete mock-up was put through 200 hours of accelerated simulated flight, which included 200 take-offs and landings and 150 hours of fast cruising. In addition, the landing gear was extended and retracted almost continually for a series of 2,000 cycles.

Accent is placed on the methods employed in testing and developing the airplane system and units rather than a discussion of the design or details of the airplane parts.

INTRODUCTION

THE ADVENT of the huge modern airplane has introduced problems of greater magnitude regarding the operation and control of the various power systems that determine the maneuverability of the airplane. With the increased size, weight, and speed, the pilot is physically unable to perform all of the required operations without the assistance of auxiliary power systems. Heretofore, in the smaller airplanes, individual items were tested or all tests were made on the finished airplane prior to its flight. The tremendous investment of the engineering design and production tooling of the large airplane makes it economically unfeasible to wait

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until the airplane is completely built before some information is obtained regarding the functional characteristics of the airplane systems.

The decision to build and conduct tests on the Lockheed Constellation hydraulic mock-up was based primarily on the desire to prove the functioning systems of the airplane. Advantage was taken of the opportunity of determining, in some cases, the best of several choices of design details, closely observing the exact performance of the items that did not readily adapt themselves to design analysis and also to permit the design engineers to observe the overall operational characteristics of the interconnecting systems in a position of greatest accessibility. In the cases of airplane equipment not meeting the engineering requirements, opportunity was afforded to test and develop individually the equipment until the engineering requirements were satisfied. This method of development does not involve the risk of even preliminary flight testing of untried systems. Just as in the case of providing for human comfort with regard to seating arrangements, doors, windows, etc., by means of a mock-up, so the Constellation's functioning systems were mocked up and their interrelated operational characteristics determined.

The tests were conducted on two similar airplane designs. The first series of tests simulated the prototype airplane. The mock-up was then revised to conform to the production version, and the simulated service tests were conducted and all former tests were repeated.

The purpose of this paper is to present the methods employed in testing the Constellation hydraulic system for conformance to engineering requirements. Of a necessity, the reasons for the design and the results of the tests will not be given or discussed, since they themselves would constitute a paper of equivalent length for each particular item.

ORGANIZATION

In order to handle expeditiously this large test program, a separate group, the Mechanical Research Group, was established in the Engineering Department. This group was charged with the responsibility of building, testing, and developing, under simulated flight conditions, the designs of the airplane functioning systems as established by the Project Design Groups. The various design groups appointed representatives who were the coordinators of all the design information and who also witnessed the various tests. In this way, close contact was maintained with the design engineers as the test progressed, and information was immediately available without waiting for test reports.

The research group functioned as a complete unit of technical personnel, which included engineers, engineering draftsmen, and assistants, with experimental mechanics under their direct supervision. As soon as the engineering designs, blueprints, and sketches were made available, either as preliminary information or final releases, they were analyzed for adaptation and/or inclusion in the mock-up. The jigs or brackets for mounting the airplane equipment were designed to simulate the airplane installation. Material requirements were established by the group and obtained through the regular purchasing and stockroom channels. Early in the program it was realized that the deflections of the mounting structure would have an important bearing on the results. Hence, the decision was made to maintain not only the structural rigidity of the test subject but also to make the jigs, platform, brackets, etc., which simulated the airplane surrounding structure, as rigid as practical.

The size of the airplane immediately determined the physical requirements of the test area. The requirement of a clear floor space approximately 100 by 100 ft. and ceiling height of 16 ft. was instrumental in the erection of a two-story research laboratory. The major portion of the upper floor housed the hydraulic mock-up and the lower floor contained the machine shop. The machined parts for the jig structures, substituted airplane parts, and, in many cases, the actual airplane parts used on

the mock-up were fabricated in the shop. In a project of this nature it was found essential to have extremely close cooperation between the one requesting fabrication and the one making the part. As is only natural, the person making the part can be of considerable help in pointing out improvements of methods of fabrication and assembly. All sources of suggestions for improvement were carefully considered and the advantageous changes incorporated.

Mock-Up Layout

The general location and arrangement in the airplane of the major members of the various functioning systems are shown in Fig. 1. The location and relative position of the components of these systems were accurately maintained in the hydraulic mock-up, as shown in Fig. 2. The mock-up was mounted on a wooden platform supported by patented steel pipe scaffolding at levels varying from $6^1/_2$ to $10^1/_2$ ft. above the laboratory floor. This height permitted installation of the landing gear mechanisms in proper relationship to the rest of the hydraulic system. It also placed the mock-up floor level approximately 3 ft. below the airplane floor level. A convenient working height was thus provided for the control cables, plumbing, etc., which in the majority of cases are located just below the airplane floor level.

As will be noted, the position of the flight station, landing gears, aileron surface control boosters, elevator surface control booster, and the rudder surface control booster are in the same relative position with regard to each other as they are in the airplane. Attention was given to duplicate accurately and in detail the plumbing installation as designed for the airplane, maintaining the correct degree and location of bends and type and location of fittings, connections, and fair-lead supports of all plumbing.

The various items of hydraulic equipment, such as the valves, cylinders, motors, and plumbing, were supported in their proper positions with appropriate brackets, jigs, and mounting pads. Cable-operated shutoff valves and selector valves were controlled by levers mounted on a control panel (Fig. 3) just forward of the center section. In the interest of simplification and accessibility, this panel did not duplicate the airplane installations and only slightly simulated the "flight engineer's station." The left portion of the panel contained the electric generator controls that supplied the current for the electric valves and indicator lights. The clocks were each connected to a pressure switch in the pump discharge line and showed the accumulated time of operation. The pressure gages, on the right, showed the system pressure. The instruments above the clocks were direct-reading temperature indicators connected to thermocouples located in the case of each pump and in the reservoir.

Each part for the mock-up was first thoroughly tested for binding, leakage, and function on a hydraulic test bench

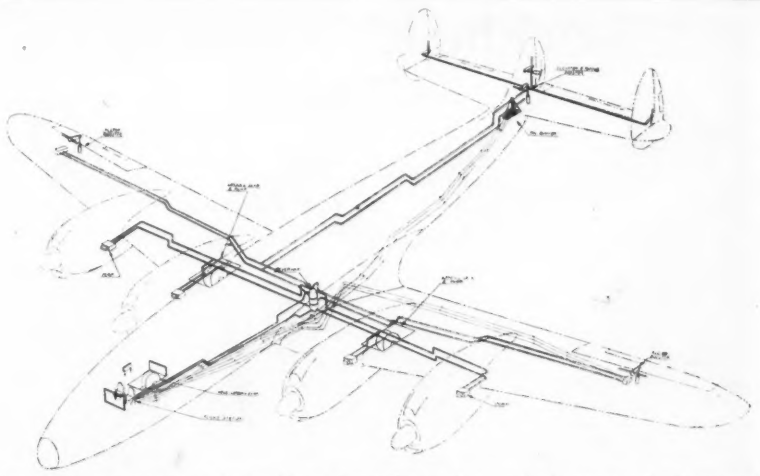

Fig. 1. Phantom view of the Lockheed Constellation showing the location and relative positions of the major members of the functioning systems.

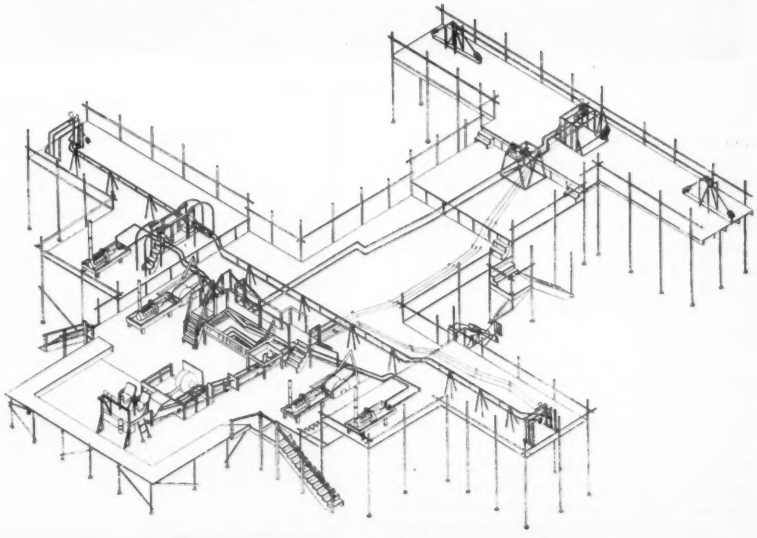

Fig. 2. Isometric view of the hydraulic mock-up.

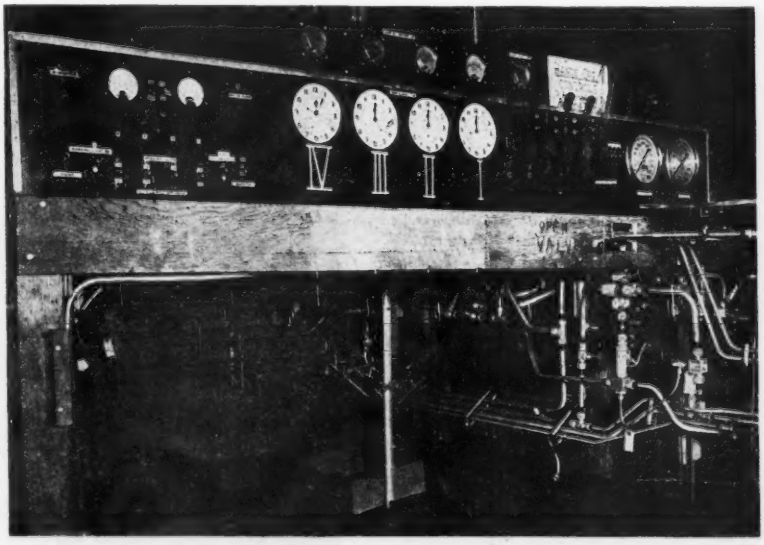

Fig. 3. Mock-up control panel.

Fig. 4. Flight station.

before installation on the mock-up. The original plan was to install all the parts and then test the complete mock-up. However, critical shortage of materials, material procurement problems, priorities, and man-power shortages dictated the testing and development of individual assemblies, with a final series of tests in which every assembly was operative.

As part of the original plan, a large pressure gage panel was provided, readily visible from the flight station. Approximately 100 pressure gages were mounted on this panel and plumbed to the various units at their location in the mock-up. Photographs obtained with a 70-mm. movie camera were utilized as the data-recording means. This method was quite successful with the exception that it was found more convenient to mount the gages nearer the unit on test where position and motion could also be recorded. Hence, the large gage panel was gradually robbed of gages and was not extensively used.

Flight Station

The flight station was mocked up with dual controls throughout, as shown in Fig. 4. The copilot's chair has been removed to show more detail. A side view of the flight station is shown in Fig. 5. In the center are the throttle controls. The control surface position indicators are shown at the right top. The autopilot is shown directly below the tachometers with one servomechanism attached to the torque tube in the foreground.

All sections of the plumbing for the brake systems, autopilot system, hand pump, etc., were installed in their relative positions, as shown in Fig. 6. The pulleys shown in the center were used to apply loads to the flight controls by means of cables and weights.

Power System

The hydraulic system consists essentially of two separate systems. One of these systems supplies power for the surface control boosters and the other supplies power for the landing gear, flaps, brakes, etc.

The airplane engines driving the hydraulic pumps were simulated with conventional V-8 automobile engines, as shown in Fig. 7. The pumps were connected to the engines by means of reversing step-up gear boxes. The speed of the engines was regulated from the controls at the flight station. This arrangement permitted operation of the pumps at various speeds, simulating all airplane conditions. The effect of simulated one-, two-, and three-engine failures with relation to the control system was fully determined with and without various combinations of landing gear and flap operation.

The performance characteristics of each pump were determined as a function of speed. Pressure gages and sharp-edged orifices were used to obtain the flow in gallons per minute versus pressure in pounds per square inch. Since these pumps are of the variable volume type, particular attention was directed to observe the pressure characteristics up to complete cutout or no-flow pressure. The suction pressure was varied to simulate altitude. Difficulties were encountered with shaft failures, apparently due to severe cavitation resulting from high suction pressures. During the course of what turned out to be a development program of hydraulic pumps, it became necessary to investigate the detailed reasons and possible remedies of the pump failures. Electrical resistance strain gages, together with an oscillograph and associated amplifying equipment, were used to study the pressure wave form. Final solution to this problem was obtained by pressurizing the reservoir.

The drive shaft seal required considerable development work. A large number of tests was made and similar tests were made at the vendor's plant. The combined efforts resulted in a satisfactory seal.

A large number of tests was made to prove all emergency possibilities of the pump and pressure systems. Total failure of various lines was simulated and remedial procedures worked out. One pump was run dry for 20 hours with the suction line closed and a simulated broken discharge line. Only at ex-

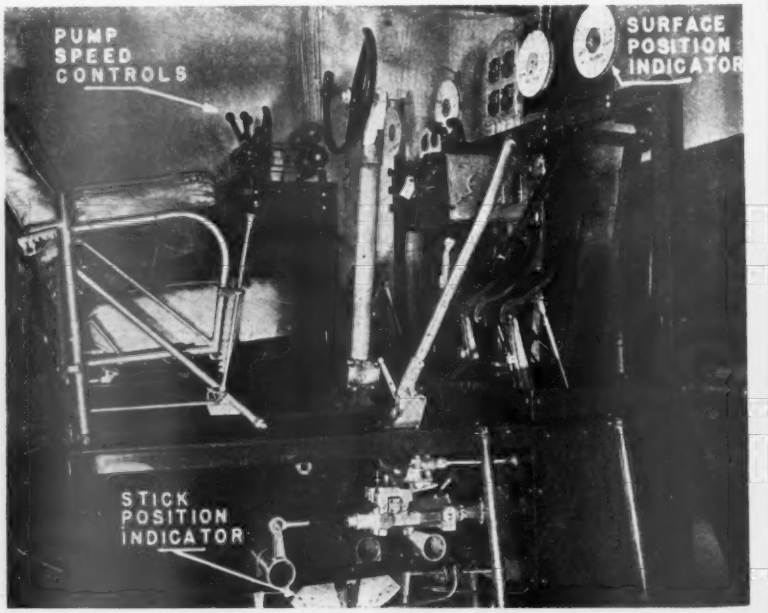

Fig. 5. Side view of flight station.

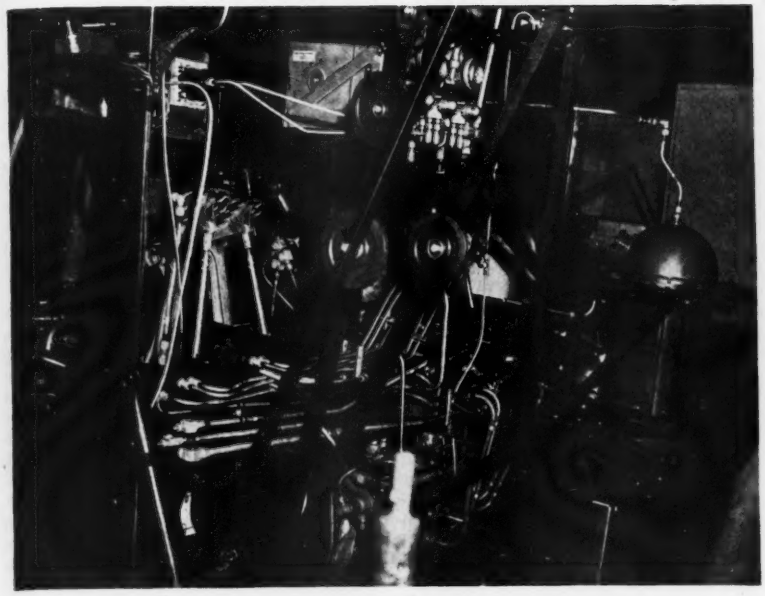

Fig. 6. Front view of flight station.

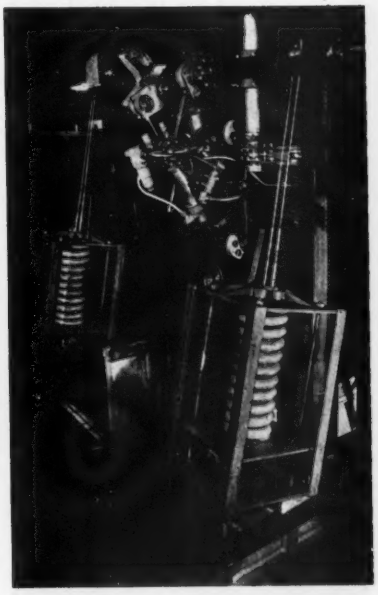

Fig. 8 Elevator and rudder surface control booster test setup.

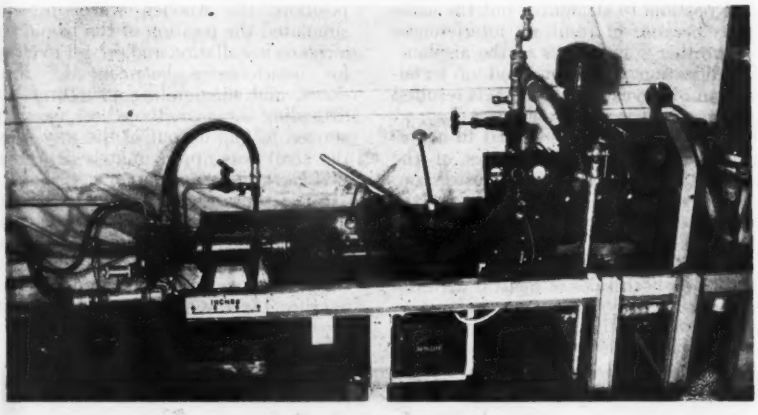

Fig. 7. Hydraulic pump and drive.

tremely short intervals was the pump given a shot of oil for the purpose of cooling and supplying lubrication.

Surface Control Boosters

The aileron, elevator, and rudder control surfaces are actuated by a system of cables with hydraulic booster units built into the cable control system in such a manner that each takes its proportion of the load required to move or sustain the surfaces against air loads. In this way, "feel" is present in the flight station cable controls. Each booster unit includes an actuating cylinder that converts the hydraulic pressure to motion and a four-way control valve that regulates the speed and direction of motion. The tests conducted consisted primarily in the determination of the degree and reliability of regulation obtained.

The individual components were bench-tested for leakage, binding, and adjustment before being assembled into the supporting airplane mechanisms and installed in the mock-up jigs. Tests were made on the overall performance for an evaluation of the control stick forces to the control surface deflection at various air loads. Four series of tests were conducted for each surface control. The first test corresponded to no simulated air load, which in effect was a test to determine adjustment and freedom from interferences. The second series of tests corresponded to a simulated air speed representing take-off and landing conditions. The third series of tests corresponded to a slow cruise. The fourth series of tests corresponded to a reasonably fast cruising condition.

The elevator and rudder surface control booster installation is shown in Fig. 8. The aerodynamic loads corresponding to the various speeds were simulated by means of large coil springs attached

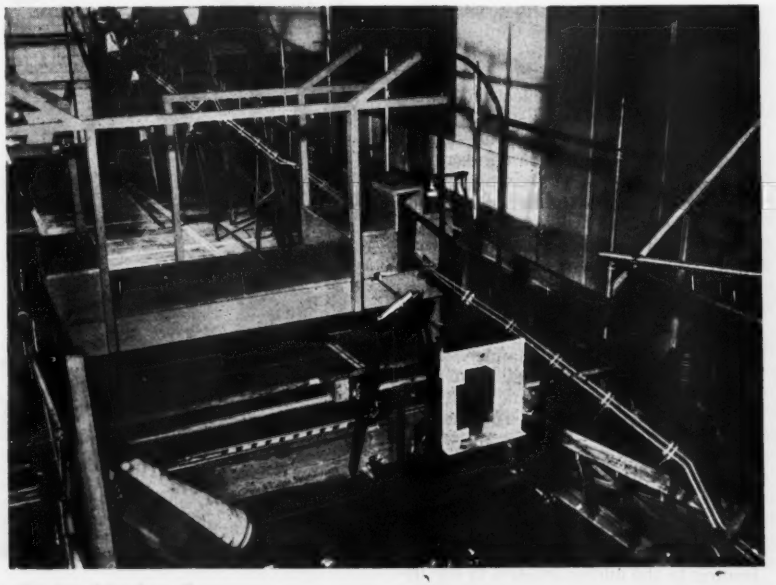

Fig. 9. Right wing mock-up.

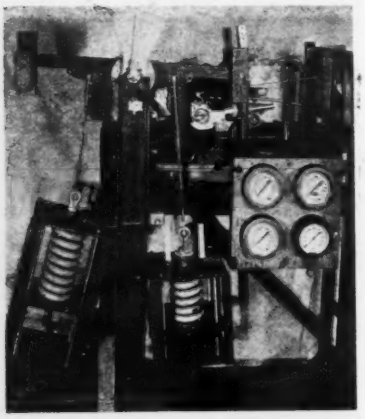

Fig. 10. Aileron surface control booster test setup.

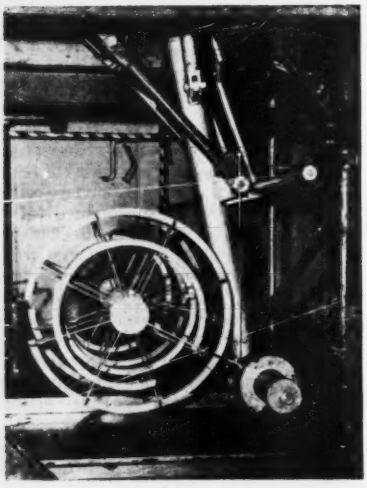

Fig. 11. Nose landing gear test setup.

to levers on the torque tubes. A change in the lever length accomplished a change in the simulated speed. These springs had a rate of approximately 3,000 lbs. per in. of deflection. They were carefully calibrated so that the developed hinge moment of the surfaces could be measured. For one series of tests, the whole jig containing the surface control boosters was enclosed with heavy insulation. The temperature of the enclosure was decreased, and complete performance tests were made down to temperatures approaching the pour-point of the hydraulic fluid.

The rudder surface control booster was tested in a similar manner. Since there are three rudders, tests were made simulating the aerodynamic load, with coil springs at the three rudder locations.

The aileron surface control booster was tested under the same conditions. The right wing is shown in Fig. 9. The main landing gear is in the foreground. The plumbing and cable system is shown leading to the aileron control in the upper left.

The aileron control is shown in Fig. 10. This is a typical illustration of the aerodynamic load simulation by means of compression springs and of the general method used to simulate the airplane installations. The weights attached to the torque tube by means of levers simulated the rotational inertia of the control surface.

An exact full-scale mock-up was made of the aileron, elevator, and rudder cable control system. When installing the cable system, special emphasis was placed on reproducing accurately the cable angle of wrap around each pulley. The friction characteristics of each system were determined at various rigging tensions only and at loads simulating take-off, cruise, and fast cruise. For each surface position, loads corresponding to a definite air speed were applied, and the force necessary on the controls at the flight station to just lift and to just release the load were measured, the booster being disconnected.

It was found that the greatest source of friction in the surface booster controls was in the cable system. It was not possible to straighten out the cable runs because of resulting interferences with other components of the airplane. Modifications in the method of termination of the cables at the ends resulted in acceptable system friction.

Similar methods were used to evaluate the overall characteristics of the control systems with the boosters on. These test results take the form of curves, correlating stick force with hinge moment when moving the surface in the direction of maximum deflection and return on both sides of neutral with the boosters on and off.

Landing Gear

All of the parts of the landing gear with the exception of the tires, wheels, and brakes were installed on the mock-up. In general, the actual airplane parts were used. When airplane parts were not available, dummy parts were constructed from the production drawings. Where function and strength would not be impaired, parts were modified for more simple construction.

All of the parts were carefully weighed, and, since the wheels, tires, etc., were not included in the mock-up strut, it was necessary to add lead weights to the strut in order to arrive at the required swung moment about the fulcrum. In the case of the nose landing gear, the fulcrum point was not high enough above the laboratory floor to allow a full length strut. Hence, a lightweight hinged wooden wheel, as shown in Fig. 11, was attached. The wooden wheels were constructed to the dimensions of the expanded tire at 20,000-ft. altitude. The hinged assembly was actuated by a cable that was attached to the lower drag link. In the retracted position, the wooden wheels exactly simulated the position of the tire in the airplane installation and served to check for interferences between the tires, doors, and surrounding structure. On extending the gear, the wheel assembly started to fold up out of the way when the strut was approximately 50° from vertical.

Since the nose gear extends forward into the wind, the simulation of aerodynamic loading was simple. It consisted of a yoke that became engaged by the strut as soon as it emerged from the nacelle. As the strut was extended, it

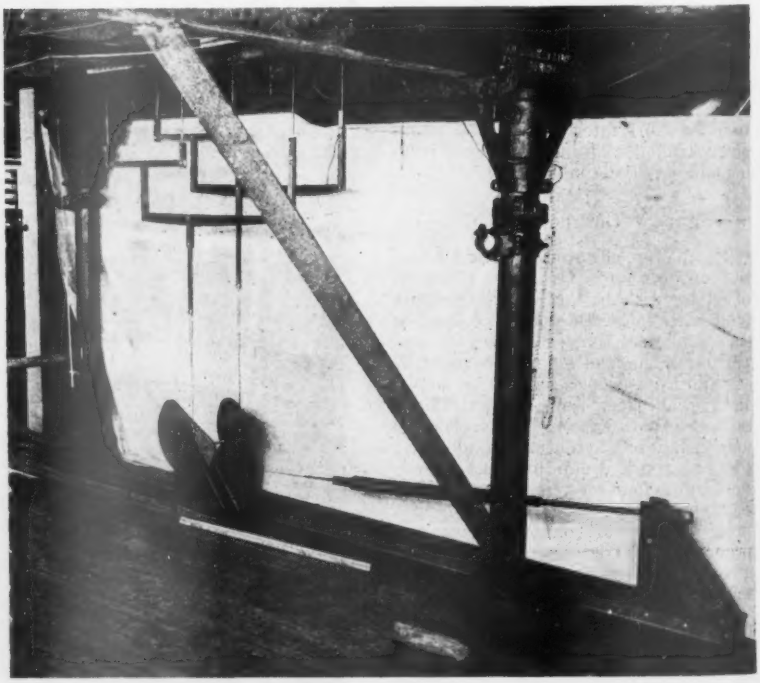

Fig. 12. Nose landing gear door loading mechanism.

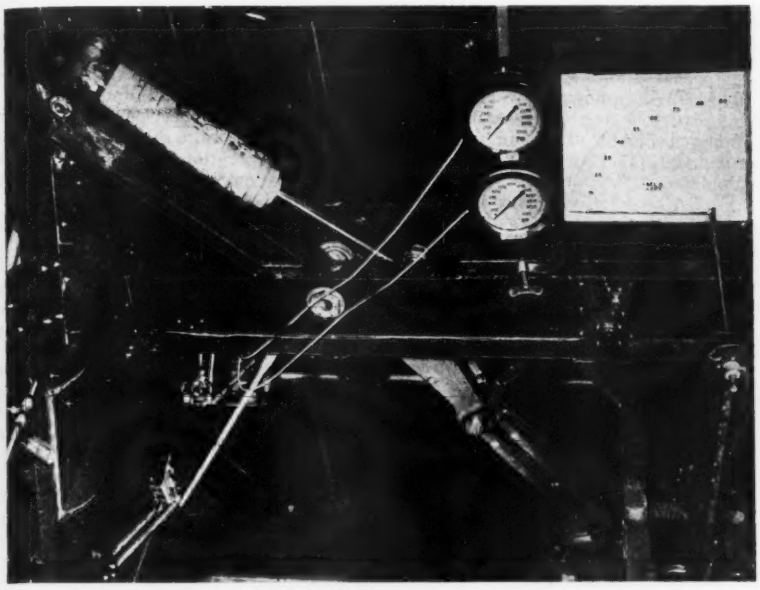

Fig. 13. Main landing gear test setup.

then lifted lead weights by means of a cable and pulley system.

The landing gear doors were loaded to simulate the aerodynamic conditions representing take-offs as high as 150 m.p.h. and landing as high as 175 m.p.h. The loading device, Fig. 12, consisted of cables, cams, and springs. The loading device was calibrated by means of strain gages and an oscillograph. Provision was made in the loading device to test fully the doors under straight and level flight and also in flight at a 10° yaw. Tests were made to determine the acceleration forces involved in the linkages of the door actuating mechanism. Accelerometers were attached directly to the doors, and oscillographic records were obtained for various load conditions and adjustments.

Both main landing gears were installed. The left gear is shown in the extended position in Fig. 13. The pressure gages connected to each side of the actuating cylinder and the protractor indicating the strut position are shown at the right. Wooden wheels, simulating the tires, were rigidly attached to the strut for the tests to determine clearances and interference between the doors and wheels as the gear was actuated. The wheels were removed after having made the adjustments insuring proper clearance. The mass of the airplane tires, wheels, and brakes was simulated with lead weights attached at appropriate positions to provide the correct swung moment about the fulcrum.

An aft view of the left inboard nacelle is shown in Fig. 14. The relative position and location of the hydraulic pump, door actuating mechanism, uplock, plumbing, etc., are apparent. The door loading attachments connect by means of pulleys and cables to the loading device shown in Fig. 15. The cam and spring arrangement closely simulate the aerodynamic load conditions. The strut air load on each main gear was simulated with a cable attached directly to the strut and pulling 1,400 lbs. of lead weight in a tram car up an inclined track, as shown in Fig. 16. In this view the strut is retracted and the load is on the flat part of the track, providing only a small horizontal force on the strut. This peculiar type of loading device closely simulates the airplane condition where a constant horizontal load is imposed on the strut during the portion of the stroke in which it is clear of the nacelle and gradually decreases as the wheel enters the nacelle on retraction and increases on extension.

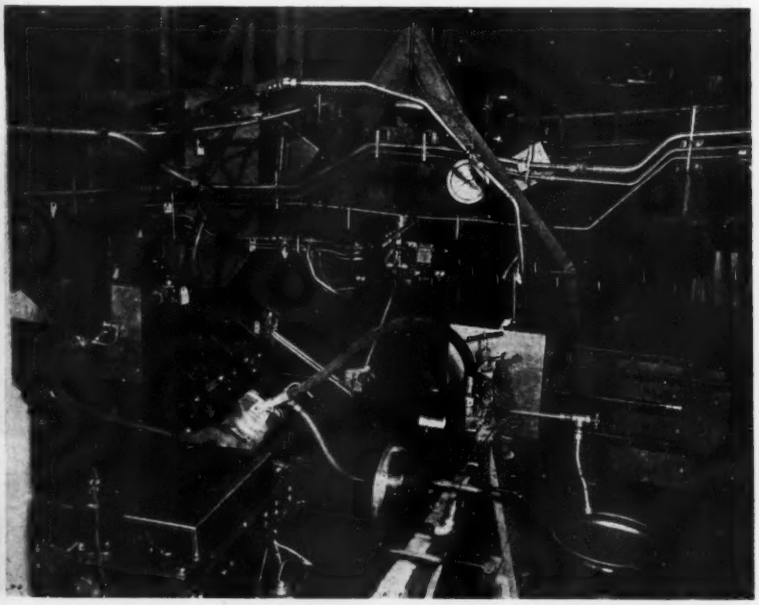

Fig. 14. Inboard nacelle test setup.

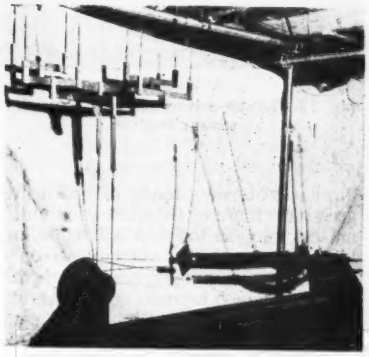

Fig. 15. Main landing gear door loading device.

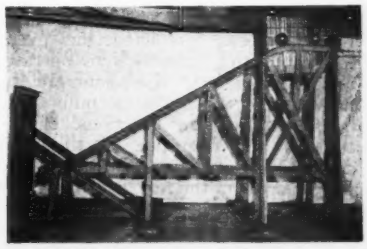

Fig. 16. Main landing gear loading device.

Tests on the landing gear were made to determine the hydraulic pressure required for extension and retraction. This resolved itself into friction measurements of different kinds of bearings. Data for the analysis were obtained by slowly actuating each gear separately and photographing the position of the gear and the pressure gages connected to the cylinder. Comparison of this information with theoretical calculations resulted in the choice of needle bearings.

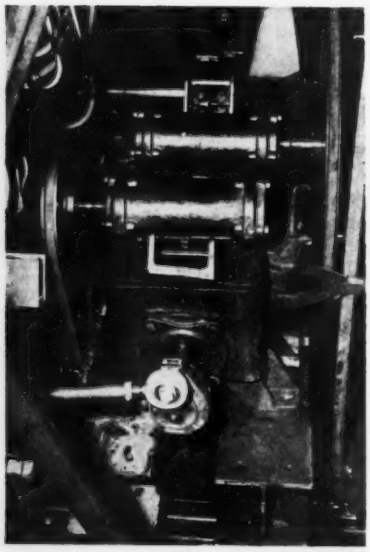

Fig. 17. Motor-driven gear box for cycling surface controls.

Similar tests were made in which progressively more of the associated mechanisms, such as the door actuation, uplock, and downlock, were put into operation. Time of extension and retraction was determined for each gear separately and then together, with various combinations of simulated engine failures as well as emergency operation with the hand pump.

Simulated Accelerated Service Test

After all of the individual functional tests had been completed, the several interconnecting systems were operated and checked out. A 50-hour preliminary test of the hydraulic pumps was made to prove the functional characteristics and operation of the drive shaft seals at extended operational time. For this part of the test, controlled flow was established through a by-pass valve.

A 200-hour simulated accelerated service test was conducted on the entire mock-up with all systems operating more severely than ever anticipated in actual flight. The surface controls were actuated by two motor-driven gear box assemblies, as shown in Fig. 17. The crank arm from the gear box was attached to a lever on the torque tube of the surface control, as shown in Fig. 18. This view shows the attachment to the rudder and aileron control. A similar mechanism was provided to actuate the elevator surface control torque tube. The rudder and aileron were operated at a rate of 15 cycles per min. and the elevator at 18 cycles per min. This difference in cycling rates imposed alternate moderate and high flow demands from the pumps. The deflection of the surface controls was approximately one-third of the maximum. During the first 17 hours, the aerodynamic loads on the surface controls were maintained at take-off conditions. For the remaining 183 hours the loads were increased to cruising speed.

The schedule of the service tests was established and duplicated at 1-hour intervals. Emphasis was placed upon uninterrupted sequence of the 1-hour simulated flights. An average of approximately 15 hours per day was accumulated.

Each 1-hour interval consisted of operating the engines for 5 min., corresponding to take-off conditions. During the next period of 45 min., the pumps were operated at a speed corresponding to a fast cruise. During this period, the pressure in the reservoir was rapidly decreased, simulating a climb to 20,000 ft. During the remaining 10 min. of the hour, the pumps were operated at a speed corresponding to approach conditions. The landing gear and flaps were extended and the reservoir pressure was increased to sea-level conditions. This procedure was repeated every hour.

The temperatures of the pump cases and the reservoir were recorded every 15 min. A continuous check was maintained on the system pressure and flow through the various items and on the general operation. Visual inspection of the various mechanisms was maintained by test personnel at all times.

This 200-hour service test was considered much more drastic than normal airplane operation. One hour of test was considered equal to at least 5 hours of normal airplane operation.

At the completion of the 200-hour service test, the landing gear, including the door actuating mechanisms, was tested for 2,000 cycles. In each case, aerodynamic loads equivalent to the most severe operating conditions were imposed.

The operation of the landing gear emergency extension system was checked before and after the 2,000-cycle test. Observations were made on the length of time and number of hand-pump operations to extend the gear.

Tests were made on the auxiliary booster system, which is a completely self-contained electrohydraulic power unit supplying fluid to the elevator

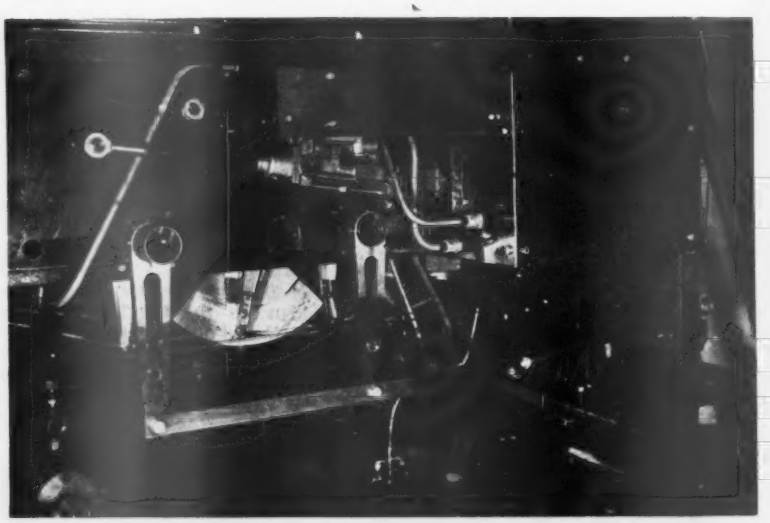

Fig. 18. Attachment of cycling device to surface control torque tubes.

Fig. 19. Cold and mud test of nose landing gear downlock.

booster system. The elevator control was cycled four times per minute for 20 hours by the automatic cycling device, which moved the elevator surface at simulated take-off and landing aerodynamic loads.

Miscellaneous Tests

At the completion of the hydraulic system tests, a series of most severe mud and ice tests was conducted on a number of landing gear components. The nose landing gear downlock was packed in dry ice and then a mixture of mud and water was poured over the mechanism, as shown in Fig. 19. Tests were then made to demonstrate satisfactory operation under these conditions. Similar tests were conducted on the main landing gear uplock (Fig. 20) and main landing gear door actuating mechanism.

Concurrent with the extensive test program of the hydraulic mock-up, all of the hydraulic and mechanical functioning items were tested in accordance with the Winterization Office Directives. These tests consist of functional, leakage, and binding determinations after specified exposures to high and low temperatures as follows:

(1) Seven-day hot soak at +160°F. in hydraulic oil (omitted in absence of nonmetallic materials).
(2) Test at room temperature.
(3) Seventy-two-hour cold soak at -65°F.
(4) Test at -65°F.
(5) Test at rapid warm-up from −65° to +40°F.
(6) Test at room temperature.
(7) Forty-eight-hour hot soak at +160°F. ambient air temperature.
(8) Test at +160°F.
(9) Test at room temperature.

Not being satisfied with the normally severe imposed operating conditions, a series of drastic contamination tests was made on the surface control boosters. High percentages of contaminants, such as water, brake fluid, engine oil, and older type of hydraulic oil, were deliberately added to the currently used hydraulic oil, and the performance limitations were determined down to temperatures of −65°F.

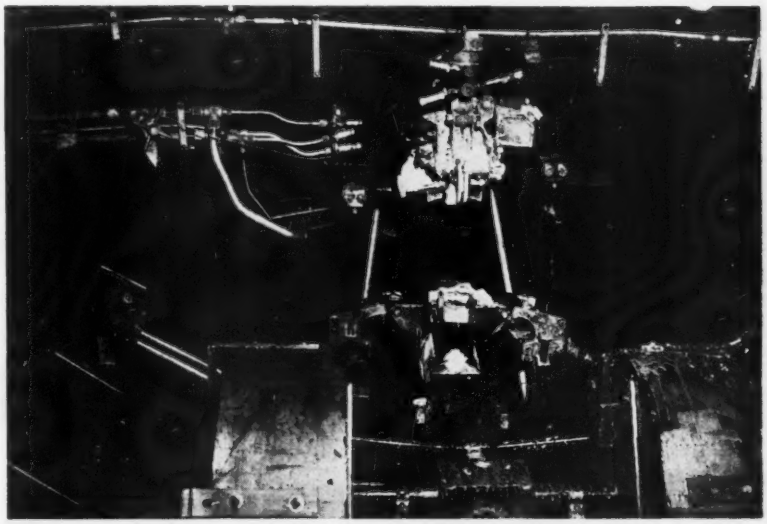

Fig. 20. Cold and mud test of main landing gear uplock.

Overall Results

The primary result of all the tests conducted on the mock-up was assurance that all of the mechanisms and component parts operated satisfactorily as individual units and as complete and interconnecting systems. In the case of failures, malfunctioning, or excessive wear, the particular items were individually tested until satisfactory solutions resulted. Valuable information was obtained to substantiate design changes that would ensure no further difficulties for the production parts. Such information took the form of ferreting out excessively sharp radii on heavily and repeatedly loaded parts that constituted stress raisers.

In the initial stages of the hydraulic pump bench test, repeated pump shaft failures and shaft seal leakage were experienced. The change of material and design of the shaft and seal, coupled with pressurized reservoir, resulted in satisfactory operation for the rest of the test program.

Valuable data on the life-expectancy of filter elements and packings of cylinder pistons and cylinder rods, valves, etc., were obtained from the extended service tests.

Excellent opportunity was given to all flight-test personnel and pilot to become thoroughly acquainted with the functional characteristics of the airplane before actual flight. Especially was this the case in determining the feel of the controls. In fact, it was as a result of the human reaction to the feel of the flight controls that some changes in the actual mechanisms were indicated. The extensive test and development program on the hydraulic mock-up of the Constellation played an important part in the initial flight of the airplane. On the first day, the airplane made six successful flights. This performance was continued during the accelerated service test of the actual airplane, in which 200 hours of flight were accumulated in 1 month's time.

Marker Light Guidance in Airplane Landing

(Continued from page 11)

conditions are present: (a) absence of daylight, (b) light or moderate traffic, and (c) atmosphere so sufficiently clear as would, by day, afford an object visibility of $^1/_2$ mile ($T = 78^1/_2$ per cent).

(2b) Marker light guidance is preferable to all other types of guidance as contact is approached under the following conditions:

By day—whenever the ground stratum of the atmosphere is not sufficiently clear to afford an object visibility of 1,000 ft. ($T = 53$ per cent), yet is sufficiently clear to afford an object visibility of 500 ft. ($T = 28$ per cent).

By night—whenever the ground stratum of the atmosphere is sufficiently clear to afford an object visibility (by day) of 230 ft. ($T = 6$ per cent).

(3a) Radio guidance is preferable to all other types of guidance for that portion of the landing operation prior to a position approximately 2,000 ft. in advance of contact when *any* of the following conditions are present: (a) absence of daylight or (b) heavy traffic or (c) daylight when atmosphere is not sufficiently clear to afford an object visibility of 1 mile ($T = 88^1/_2$ per cent).

(3b) Radio guidance is preferable to all other types of guidance as contact is approached under the following conditions:

By day—whenever the ground stratum of the atmosphere is not sufficiently clear to afford an object visibility of 500 ft. ($T = 28$ per cent).

By night—whenever the ground stratum of the atmosphere is not sufficiently clear to afford an object visibility of 230 ft. ($T = 6$ per cent).

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Institute News

Arthur E. Raymond, 1946 I.A.S. President

Arthur Emmons Raymond, Fellow of the Institute and Vice-President in Charge of Engineering of Douglas Aircraft Company, Inc., has been elected President of the Institute for 1946, succeeding Charles H. Colvin.

Mr. Raymond has been a member of the Institute for many years, rising progressively to his present grade, in 1937, in reflection of his accomplishments as an aeronautical engineer and in recognition of his contributions to the advancement of the aeronautical sciences.

In addition to his responsibilities as an engineering executive of Douglas Aircraft Company, Inc., Mr. Raymond has served since 1927 as Assistant Professor of Aeronautical Engineering at the California Institute of Technology.

Among the articles and papers of which Mr. Raymond is the author are "Ground Influence on Aerofoils," constituting *N.A.C.A. T.N. No. 67;* "Designing to Please Air Travelers"; "Landplanes or Flying Boats"; "The Mold Loft, Its Economical Application to Aircraft Construction"; and "Progress in Airplane Design During 1941."

Rear Adm. Luis de Florez Receives the D.S.M.

Rear Adm. Luis de Florez, U.S.N.R., Assistant Chief of the Naval Research Laboratories, and a Fellow of the Institute, was awarded the Distinguished Service Medal, the presentation being made by Undersecretary of the Navy Artemus L. Gates on November 6.

The award of the Distinguished Service Medal was made for Admiral de Florez' services as Director of the Special Devices Division of the Bureau of Aeronautics and as Assistant Chief of the Office of Research and Inventions, at which time he was a Captain.

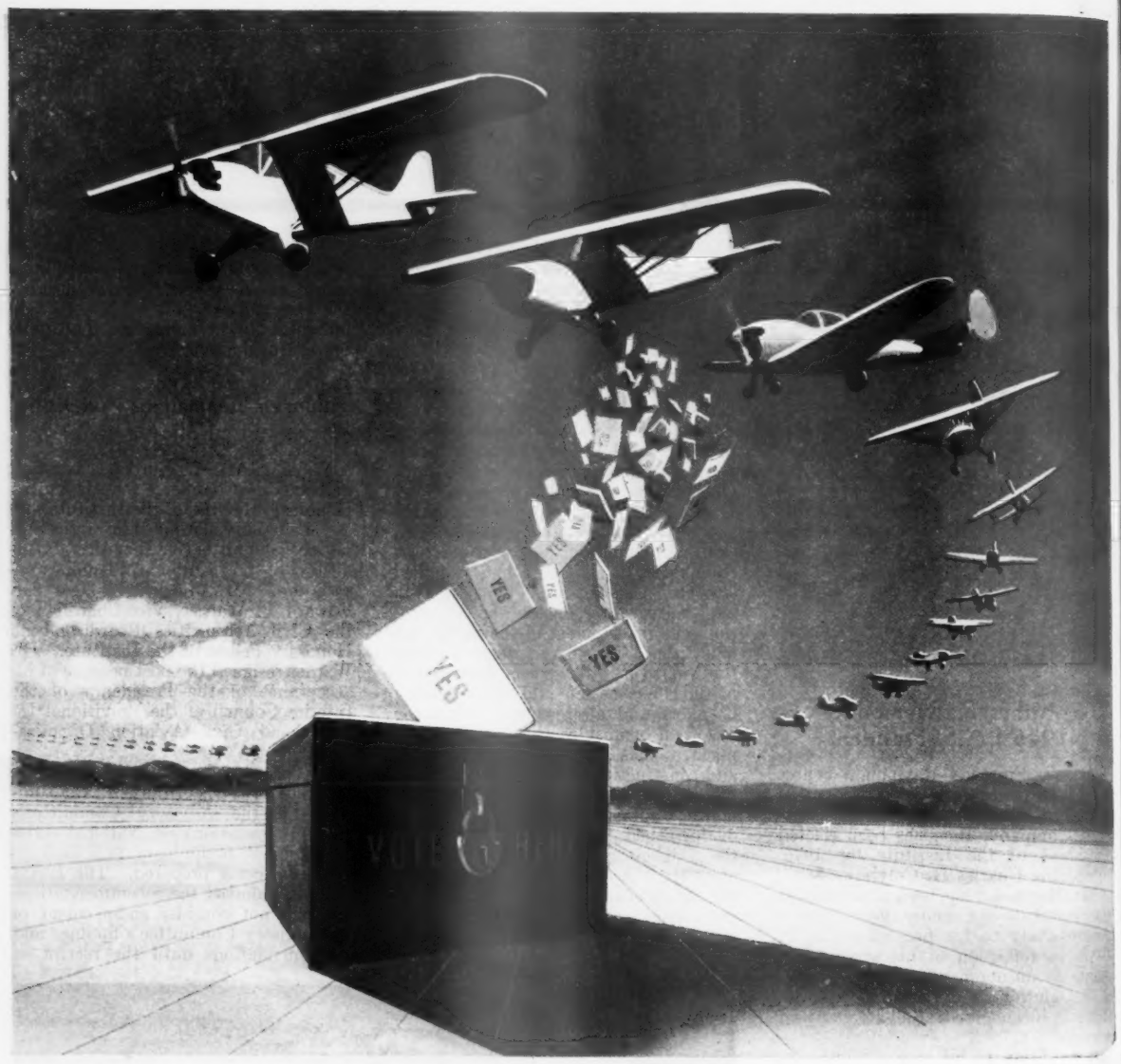
The citation reads as follows: "For exceptionally meritorious service to the Government of the United States in a duty of great responsibility as Director of the Special Devices Division of the Bureau of Aeronautics and as Assistant Chief of Research and Inventions, Navy Department. Exercising extraordinary genius, resourcefulness, and professional skill in carrying out an assignment far reaching in its various fields of applied sciences, Captain de Florez was in large measure responsible for the creation and development of the unique art of synthetic training perfected during the war to provide special devices and methods for the safe and rapid training of pilots and aircrewmen. From the inception of an idea through the complicated phases of invention, research, and construction to the final aspects of production, distribution, and maintenance, Captain de Florez has rendered distinguished service toward realizing the highest potential in training methods, not only for Naval Aviation but for submarine officers and fire-control parties engaged in combat patrol. His broad vision, inspiring leadership, and limitless enthusiasm in the fulfillment of a particularly specialized and exacting assignment were contributing factors in our successful prosecution of the war and reflect the highest credit upon Captain de Florez and the United States Naval Service."

Burden Summarizes Aviation Policy

William A. M. Burden, Assistant Secretary of Commerce for Air and an Honorary Member of the Institute, has assumed the Chairmanship of the Advisory Committee on the Aircraft Industry of the National Planning Association. Mr. Burden replaces Dr. Edward P. Warner, Vice-Chairman of the Civil Aeronautics Board and an Honorary Fellow of the Institute. Dr. Warner resigned the post because of his acceptance of the Presidency of the Interim Council of the Provisional International Civil Aviation Organization.

Mr. Burden has submitted to the Board of Trustees of the N.P.A. a summary of the Advisory Committee's "Recommendations on National Aviation Policy," preliminary to a final report now being prepared. The Board has not endorsed the recommendations and will not consider endorsement of the Advisory Committee's findings and recommendations until the receipt of

Rear Adm. Luis de Florez receiving the Distinguished Service Medal from Undersecretary of the Navy Artemus L. Gates.



5,000 WERE ASKED . . . As a guide to the private plane manufacturer in developing his new models, more than 5,000 pilot and pilot-owner members were recently asked by the Aircraft Owners and Pilots Association to state, on the basis of their experience, their instrument requirements in the new planes which they planned to purchase. ¶ The replies of this experienced group, three-fourths of whom are or have been plane owners, will be of interest to all who, themselves, plan to purchase planes. ¶ The results showed that these pilots were overwhelmingly in favor of "better" instruments than most private planes contained. And they were willing to "pay more" to get them. Reasons: "To make flying safer . . . to increase the utility of my ship . . . for efficiency and economy." Over 80%, for instance, want Sensitive Altimeters in their new planes. ¶ To meet the need so clearly outlined by these thousands of pilots, Kollsman has developed a new line of instruments designed and *priced* for the private plane owner. Full details of these instruments will shortly be announced. ¶ Meantime, Kollsman is making available the pilots' answers to the sixteen basic questions in the AOPA Survey. For your copy, write Advertising Dept., Kollsman Instrument Division, Square D Company, 80-08 45th Avenue, Elmhurst, N. Y.

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William A. M. Burden.

the final report, but, because of the immediate problems facing the nation in connection with reconversion of the aircraft industry, it was felt that preliminary recommendations of the Advisory Committee should be made available to the public as soon as possible. Mr. Burden's summary is made public by the Board as a stimulus to discussion of an important national problem. The final report, upon completion, will be reviewed in a later issue of the AERONAUTICAL ENGINEERING REVIEW.

N.A.C.A. Elects Officers

Dr. J. C. Hunsaker, an Honorary Fellow of the Institute, was re-elected Chairman of the National Advisory Committee for Aeronautics at a formal meeting of the N.A.C.A. on October 25. T. P. Wright, Administrator of Civil Aeronautics and an Honorary Member of the Institute, was elected Vice-Chairman.

Dr. Hunsaker was also elected Chairman of the Executive Committee and Dr. F. W. Reichelderfer, Chief of the U.S. Weather Bureau and a Fellow of the Institute, was elected Vice-Chairman.

Officers of the National Advisory Committee for Aeronautics are elected annually by Committee members.

Northrop to Operate Aviation School

Northrop Aircraft, Inc., will operate a new aviation school, the Northrop Aeronautical Institute, offering aeronautical engineering and air-line maintenance courses.

Designed to fill the growing need for technicians, engineers, and administrators, the Northrop Institute will offer both home study and resident courses, beginning in the first quarter of 1946. Extension courses, based on new methods of home-study presentation, will open in January, while the resident school will hold its first classes in March.

Two new buildings and a large field hangar at Northrop Field will house the Northrop Institute. A placement bureau will be operated in connection with the new school.

Gifts to the Aeronautical Archives

Allan D. Emil gave a bound volume of the first 64 numbers of *L'Aviation Illustrée*, from January, 1909, to February 1, 1911, and *Unsere Luftstreitkräfte, 1914–1918, ein Denkmal Deutschen Heldentums*, edited by Gen. Walter von Eberhardt, Berlin, 1930.

A model of the F4U4 Corsair fighter airplane, and a framed colored lithograph of it, were received from the Chance-Vought Aircraft Division of United Aircraft Corporation, through the courtesy of Rex B. Beisel. Dr. Raffaele Giacomelli sent his book, *Il Terrorismo Aereo, Nella Teoria e Nella Realta*, Rome, 1945, and a supplement on the atomic bomb. Three flight engineer's computers of the 20th Air Force and a sleeve patch of the Operations Analysis Section were received from Frederick F. Fennema.

Col. G. DeFreest Larner sent six pictorial postcards and two booklets of the Lafayette Escadrille Memorial, near Paris, and other aeronautica. The Curtiss-Wright Corporation sent files of twelve house organs for 1942, 1943, and 1944, through the courtesy of Elma T. Evans.

Eighteen cartons of clippings, documents, pamphlets, photographs, and other aeronautical source material were sent by *Aviation*, through the courtesy of Leslie E. Neville, adding to its previous generous gifts. Among other previous donors to the Archives, were Col. Stedman Shumway Hanks, who gave his book, *Flight Strips, Bargain Airports*, and Dr. Alexander Klemin, who gave documents and pamphlets. Mrs. Bella C. Landauer gave a porcelain snuff box of about 1908, with a picture of an Antoinette monoplane on the cover, a scarf with balloon design, and an original pen-and-ink drawing of about 1910, by A. B. Shults, adding to her previous gifts. Francis Lieber added aeronautical periodicals and pamphlets to his previous gifts.

Documents relating to applications before the Civil Aeronautics Board for new air routes or extensions of existing routes were received from Eastern Air Lines, Inc., Spartan Aircraft Company, Inc., Transcontinental & Western Air, Inc., and United Air Lines, Inc.

Among other donors during the month were the Air Transport Association, American Society for Testing Materials, Haire Publishing Company, T. Milewski, R. B. Phillips, Leon Z. Seltzer, and the U.S. Adjutant General's Office, Air Technical Service Command, Army Air Forces, Bureau of Mines, Civil Aeronautics Administration, Department of Agriculture, Department of the Interior, Department of Labor, Library of Congress, Office of War Information, War Department, Weather Bureau, and the Senate and House document rooms.

Aeronautical Engineering Catalog, 1945 Edition

The Institute announces the release for distribution of the AERONAUTICAL ENGINEERING CATALOG, 1945 Edition.

Published as a reference guide for aeronautical designers and engineers, this catalog contains specifications and engineering data on a wide variety of aircraft products available for postwar commercial and military airplanes. The only reference source of its kind, the CATALOG also lists in its more than 600 pages the sources of supply of over 2,000 items manufactured by more than 1,800 companies.

Larger and more complete than last year, the new edition offers technical information about aircraft products ranging from rivets to gas turbines and jet-propulsion engines, marking the first time aircraft jet-engine copy has appeared in any general catalog.

Established in 1944 as an annual publication, the CATALOG is an official publication of the Institute.

Air Line Changes Name

The official name of American Export Airlines, Inc., has been changed to American Overseas Airlines, Inc. The air line is the overseas operating division of the American Airlines System and is a Corporate Member of the Institute.

Plan Now To Attend

I.A.S. Honors Night Dinner

Grand Ballroom, Hotel Waldorf-Astoria, N.Y., Monday, January 28, 1946

Lt. Gen. James H. Doolittle, Past-President and Fellow of the Institute, will be the guest speaker at the dinner. The complete program of the dinner and of the honors and awards to be presented will be sent to all members of the Institute during December.

Fourteenth Annual Meeting

Columbia University, New York, N.Y., January 29, 30 and 31, 1946

The complete program of the technical sessions of the Fourteenth Annual Meeting will soon be available for distribution to all members.

Members and others planning to attend meetings and dinners of the Institute are urged to make early train and hotel reservations.

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Air Transport Meeting

The Third National Air Transport Meeting of the Institute was held at the Hotel Statler, Washington, D.C., on Thursday, October 25. Approximately 250 members and guests registered for the two sessions of the meeting.

The program was opened by A. W. Dallas, Director, Engineering Division, Air Transport Association of America, who presided over the afternoon session. Chairman of the evening session was J. Parker Van Zandt, Director of Aviation Research, The Brookings Institution.

Between sessions, a Council Reception and Dinner held in the Pan American Room was attended by speakers, chairmen, and guests of the Institute. Those present were: J. C. Hunsaker, Chairman, N.A.C.A., and Hugh L. Dryden, Chief, Mechanics and Sound Division, National Bureau of Standards, both Past-Presidents of the Institute; Mr. Dallas and Mr. Van Zandt; Dr. F. W. Reichelderfer, Chief, U.S. Weather Bureau and Chairman of the Washington Section; and Eugene W. Norris, Manager, Technical Department, Aircraft Industries Association of America and Secretary of the Washington Section. Speakers at the meeting were Harry S. Pack, Vice-President, P-V Engineering Forum, Inc.; C. H. Schildhauer, Captain, U.S.N.R.; W. M. Masland, Captain, Pan American Airways System; and Orland E. Esval, Director, Aeronautical Instrument Research, Sperry Gyroscope Company, Inc.

Guests present included L. Welch Pogue, Chairman, Civil Aeronautics Board; William Littlewood, Vice-President, Engineering, American Airlines, Inc., John Geisse, Assistant to the Administrator for Personal Flying Development, C.A.A. Officers of the Institute who attended were Charles H. Colvin, President; Lester D. Gardner, Chairman of the Council; Bennett H. Horchler, Executive Vice-President; George R. Forman, Assistant to the President; and Robert R. Dexter, Secretary.

The complete program, including abstracts of the papers presented, appears below. All papers will be considered by the Editorial Board for publication in the JOURNAL OF THE AERONAUTICAL SCIENCES or the AERONAUTICAL ENGINEERING REVIEW.

2:00 P.M. Session

Chairman: A. W. Dallas
Director, Engineering Division
Air Transport Association of America

Trends in Aircraft Instrument Development—Orland E. Esval, Director, Aeronautical Instrument Research, Sperry Gyroscope Company, Inc. This was a discussion of flight indicators and gyro pilots as applied to military and air transport. It dealt with certain instrument developments by the Sperry Gyroscope Company for military airplanes during World War II. The equipment is now becoming available for commercial operators, and therefore it is of considerable interest to air lines. Development and improvement of flight indicators, such as the Gyro Horizon, Directional Gyro, Attitude Gyro, and Gyrosyn Compass, were described. Included was a statement of some of the controversial issues of flight indication and a summary of apparent trends. New requirements for automatic pilots were given. A new gyro pilot designed to meet these requirements was described.

Economic Aspects of the Helicopter in Transport Operation—Frank N. Piasecki, President, P-V Engineering Forum, Inc.

The need for a new type of vehicle to supplement present-day and future transport operations was discussed. Gaps in the efficient use of time and reduction of costs because of the airplane's necessity for ground maneuvering on large, flat fields far from the centers of population, were investigated. The helicopter as a transport was presented as a solution to these shortcomings.

The status of the helicopter industry in the United States and other countries, from the standpoint of its ability to supply machines meeting transport requirements, was reviewed. Detailed operating characteristics were disclosed on the commercial version of the Navy's Heli-Transport, the PV-3. Weights, performance, and functional features of this machine were presented.

Costs of operation were worked out, using the Air Transport Association formula based on known data. Assumptions were discussed and detailed breakdowns of costs were carried out. Comparison of the developed operational costs and service of today's helicopter with existing forms of ground service and handling was outlined. The helicopter's possibilities in short-haul transportation and its operating limits were established on the basis of present-day design data. Movies of the PV-3 Heli-Transport performing various flight and operational maneuvers were shown.

Problems in Transatlantic Air Transport—W. M. Masland, Captain, Atlantic Division, Pan American Airways System. Some of the problems were outlined which must be solved before transatlantic commercial flights may operate on highly regular schedules, and with a figure for allowable cabin load known well enough in advance to permit full advantage to be taken of the advance sale of space. Part of the data given in this paper was provided by Capt. A. C. Clark, Chief Meteorologist, and Capt. F. K. Shader, of the Atlantic Division of Pan American Airways. The problems imposed by the various elements of weather were briefly touched upon, with mention of possible solutions to all of them except the problem of winds of excessive force.

A series of curves of north Atlantic wind components was presented showing velocities encountered plotted for frequency of occurrence. Translating these curves into curves of available cabin load on a prewar type of plane showed ACL variations of from three to one for summer operations. It had been hoped that high-speed equipment would solve this problem. A series of curves showing the relationship between air speed and per cent increase in flight time for head winds of various forces was presented. This indicated that the problem of varying ACL's will remain until supersonic air speeds are achieved. Various methods of meeting this problem were suggested.

Because of the unfavorable ratio between fuel load and cabin load it is felt that fuel economy remains a matter of prime importance. There followed a general description of various ways in which small but important economies might be effected.

7:30 P.M. Session

Chairman: J. Parker Van Zandt
Director of Aviation Research
The Brookings Institution

Possibilities for Improving Air-Line Operating Efficiency in the Future—Harry S. Pack, Vice-President, P-V Engineering Forum, Inc. The progress that has been made in air-line operating efficiency was discussed and still further need for improvement was indicated. Possible methods of improvement were suggested, including revision of organization charts of some air lines to streamline and decentralize many of the operations. It is believed that one of the weakest points is top management, which is responsible for the "underplanning" and "penny-wise, pound-foolish" philosophy that has greatly hampered some of the air lines in the past. In order to sell service, future traffic departments must acquire the imagination necessary to see beyond the limits of today—new blood is needed. Engineering departments have been progressive in thinking but weak on taking action on new developments. This department has, in the past, had a tendency to allow others to solve problems for them. New types of aircraft must be considered, developed, and used.

A number of possibilities for improving operating efficiency in both flight and on the ground were discussed, touching on better equipment, facilities, and procedures.

Flying Boats—C. H. Schildhauer, Captain, U.S.N.R., Naval Air Transport Service Command. The advantages of the flying boat over the landplane have become controversial. The establishment of a firm program for the development of long-range patrol planes and long-range, high-altitude bombers for military operations is advocated, based upon the usefulness of flying boats in the past war. Increased efficiency in this respect can be obtained by higher wing loadings, reserving the present low wing loading for aircraft in rescue operations on the high seas, a necessary type of military operation with flying boats. New power plants embodying the gas turbine principle can be equally efficient on flying boats or landplanes.

The development of the commercial transport flying boat will take advantage of higher wing loadings, new power plants, and increased handling efficiency with in-

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creased size. This development will produce a low-cost form of transportation because of the increase in useful load of the larger flying boats, particularly those in the vicinity of 400,000 to 500,000 lbs. gross weight. The international air-transport industry must realize that it is not speed that is essential—it is low-cost transportation. The potentialities of the flying boat conclusively tend toward satisfactorily rapid air transportation on long flights at cost under that of the landplane. To meet foreign competition, use of both landplanes and flying ships is essential, and the military and commercial future of our country must not neglect their parallel further development.

Standardization of Navy Cockpit Arrangement—Luis de Florez, Rear Admiral, U.S.N.R., Assistant Chief of the Naval Research Laboratories. It is difficult to recognize the important part that tradition has played in the design of cockpits. The blind spot caused by the single-engined plane has created a location for the instrument panel which has never varied, even though the opportunity exists in twin-engined aircraft to get much greater forward visibility. Circular-reading instruments have remained standard, regardless of the undesirability of reading flight and engine conditions in this manner. Although engineers have improved the performance of aircraft, it is no longer a question of how much gasoline can be carried in the plane, but rather how long the pilot can fight fatigue and carry out his mission effectively.

As the result of a joint Army-Navy-National Research Council conference, the work of designing standardized Navy cockpits has been initiated, and many different mock-ups have been built by the Special Devices Division of the Office of Research and Inventions. This work includes not only the simplification of instrument arrangement but also investigations into the utilization of other senses besides that of sight.

Preliminary work indicates that sound can be used to substitute for visual

I.A.S. Meeting Preprints

A limited number of copies of preprints of papers presented at meetings of the Institute are available for distribution, at a charge of 25 cents each to members of the Institute, and 50 cents to nonmembers, to cover handling and mailing charges. The following lists preprints available from the past three national meetings of the Institute.

SUMMER ANNUAL MEETING

Los Angeles, Calif. **August 16–17, 1945**

Aero-Medical Aspects of Cabin Pressurization for Military and Commercial Aircraft—Col. W. Randolph Lovelace, II, and Lt. Col. A. P. Gagge, Aero Medical Laboratory, Engineering Division, Air Technical Service Command, Wright Field. 11 pages; 5 illus.

Armament for Jet-Propelled Bombardment Airplanes—R. A. Averitt, Armament Section, Aviation Division, General Electric Company. 11 pages; 4 illus.

Glass Laminates and Their Application to Aircraft Structures—Capt. George B. Rheinfrank, Jr., and Capt. Wayne A. Norman, Engineering Division, Air Technical Service Command, Wright Field. 17 pages; no illus.

Icing Problems and the Thermal Anti-Icing System—F. L. Boeke and R. A. Paselk, Heating and Ventilating Engineers, North American Aviation, Inc. 45 pages; 19 illus.

*Research and the Army Air Forces—Brig. Gen. L. C. Craigie, Chief, Engineering Division, Air Technical Service Command, Wright Field. 4 pages; no illus.

Structural Design Problems in the B-29 Airplane—George Snyder, Chief of Structural Design, Boeing Aircraft Company. 9 pages; 7 illus.

LIGHT AIRCRAFT MEETING

Detroit, Mich. **October 4–5, 1945**

Compatibility of Roadability and Landing Requirements in Aircraft Undercarriages—Reinhardt M. Rosenberg, Design Specialist, Nashville Division, Consolidated Vultee Aircraft Corporation. 25 pages; 5 illus.

Control Operation of Spratt Wing—George G. Spratt, Nashville Division, Consolidated Vultee Aircraft Corporation. 11 pages; 9 illus.

Itinerant Aircraft Radio—H. T. Sagert, Sales Manager, Aviation Radio Division, Lear, Incorporated. 25 pages; no illus.

NATIONAL AIR TRANSPORT MEETING

Washington, D.C. **October 25, 1945**

Flying Boats—Capt. C. H. Schildhauer, U.S.N.R., Naval Air Transport Service Command. 9 pages; no illus.

* Published in the October issue of the Aeronautical Engineering Review.

PLANE TALK

Haskelite's thorough knowledge of aircraft plywood requirements is based on 27 years of experience in perfecting and manufacturing this material. The result: a new standard for aircraft plywood. The uniformity and dependability of Haskelite Aircraft is assured by careful selection and testing of the individual veneers, and close control and engineering of the material in production. For example, in 1944-1945 over 100,000 sq. ft. of material was used for test purposes in the Haskelite laboratory in order to guarantee this high quality.

This policy has meant that Haskelite Aircraft Plywood panels will surpass the existent Army-Navy specifications. This is why aircraft plywood made by Haskelite has proved itself to be the Quality aircraft plywood since 1917.

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observations in, for example, binaural homing on a radio beacon or station. The redesigned cockpit is "clean," with all edges and corners rounded. The instrument panel is flush, and consideration has been given to the use of a disposable panel containing all light switches. Controls and switches have been arranged according to the use and frequency of their use, and particular attention has been paid to the accessibility of emergency equipment.

This project is one that will never be completed, for it must continue as long as improvements are made in aircraft and engines. The work to date is merely a completion of the first phase, but it is recognized as the basic pattern for simplification, standardization, and the reduction of training time and hazards.

Sections and Branches

Buffalo Section

On November 7 the Buffalo Section held a dinner and meeting at the Park Lane Dining Room in Buffalo. Robert A. Wolf, Vice-Chairman of the Section, presided.

Bartram Kelley, Helicopter Development and Design Engineer at Bell Aircraft Corporation, read his paper on "European Helicopter Development." Mr. Kelley related the results of his trip to Europe to study helicopters, describing four German helicopter projects, two Focke's, the Flettner machine, and Doblhoff's reaction-driven rotor helicopter. He stated that reports on these projects will be available through the Resources Control Office of the War Production Board at Washington. Slides were shown of mountain scenes encountered on the journey.

The following Committee Chairmen were announced: Membership, William Duke, of Curtiss-Wright Research Laboratory; Nominating, Fredric Flader, of Fredric Flader Corporation; Meetings and Papers, Robert A. Wolf, of Bell Aircraft Corporation. Harold Hirsch, of Curtiss-Wright Research Laboratory, was appointed Treasurer.

Miami Section

At a meeting of the Miami Section on November 7, Harry W. Flanders, Service Analysis Representative of Douglas Aircraft Company, Inc., spoke on the subject "Service Analysis of Commercial Aircraft by Douglas Aircraft Company." The talk covered the practice of stationing representatives with key air lines for the purpose of analyzing their maintenance problems and parts replacement difficulties, the goal being to perfect future aircraft for this type of operation with a minimum of maintenance. Mr. Flanders emphasized the importance to designers of the problem of the accessibility of aircraft to maintenance. He stated that the ease with which a plane can be overhauled or serviced is a determining factor in its selling value. The speaker also brought out the importance of maintenance analysis in determining the size and nature of the stock of replacement parts. A general discussion of the manufacturer's assistance to air lines followed.

The new Constitution was reviewed and the date of the next meeting was set for December 5 to be held at the Opa-Locka Naval Base. The intended subject is "Naval Air Power and Advancement."

B. C. Stephens, Section Chairman, presided.

Seattle Section

The following officers of the Seattle Section were elected at a meeting on October 10: Chairman, A. Elliot Merrill, Flight Test Pilot, Project Engineering, Boeing Aircraft Company; Vice-Chairman, James E. Conner, Assistant Maintenance Superintendent, Pan American Airways, Inc.; Treasurer, K. K. McDaniel, Group Engineer in Charge of Design, Boeing Aircraft Company.

The meeting was reported in the November issue of the AERONAUTICAL ENGINEERING REVIEW.

Academy of Aeronautics

Business meetings of the Branch were held on October 9 and 16. Thomas J. Knust, Chairman, appointed the following chairmen of the standing committees: Edwin Siekierski, Social; Daniel McElwain, Initiation; Margaret Liebhauser, Publications; Frank Tedesco, Executive. At meetings on October 22 and 29, final preparations were made for a banquet to be held on November 2. Parliamentary procedure was discussed at the October 29 meeting and Chairman Knust read a report on the proper method of presenting motions.

Georgia School of Technology

At a technical meeting of the Student Branch held on October 10, Mr. Richmond spoke about the activities of Bell Aircraft Company.

Illinois Institute of Technology

The film *The Bell Helicopter* was shown at a meeting of the Branch on August 31.

During the last week of September the members visited the Douglas Aircraft Company plant at Park Ridge, Ill. On separate days the tours were conducted by Professor Fiesenheiser and Dr. Charles O. Harris, Faculty Adviser of the Branch.

At a technical meeting on October 12, a talk on the "Outline of the History of Aeronautics" was given by M. B. Wells, Faculty Member and Consulting Engineer, who taught the first aeronautical engineering class at the Illinois Institute of Technology. Only one meeting was held in October because the semester ended on October 24.

Iowa State College

At a combined technical and business meeting of the Student Branch, the film *The Bell Helicopter* was shown. Charles Byrnes, of the Solar Aircraft Company, presented this semester's design award to Calvin D. Wadleigh.

An election of officers was held to replace men leaving for Navy duty elsewhere. Those elected were: Robert Johnson, Chairman; Oscar Stokka, Vice-Chairman; Theodore Moorman, Secretary-Treasurer. William Roush was appointed Program Chairman; Ivan Taylor, Senior Engineering Council Representative.

Massachusetts Institute of Technology

On October 10 a business meeting was held at which plans were discussed for an intended trip to the plant of the Chance Vought Aircraft Division of United Aircraft Corporation.

New York University

On October 11 the Student Branch held a business meeting at which there were informal discussions of reorganization, collection of dues, and admission of new members. Plans were formulated for future meetings.

At a technical meeting on October 23, Ralph H. Upson, Consulting Engineer, spoke on "Advantages of Low-Wing over High-Wing Aircraft."

University of Oklahoma

The following officers were elected at a business meeting held in the Engineering Auditorium on October 8: Tom Gayle, Chairman; Alvin Petrik, Vice-Chairman; O. D. Bradley, Secretary-Treasurer.

New members accepted were Jack B. Ligon, C. Glen Harvey, John M. Hoffmann, and Samuel R. Gray. The film *Streamlined* was shown.

Polytechnic Institute of Brooklyn

At a technical meeting on August 14, B. Klein gave a talk on "Performance Design." He showed that it is possible to develop five independent equations whereby wing loading, aspect ratio, coefficient of parasite drag, and fuel-weight ratio could be found by semiempirical means.

A technical meeting was held on October 25, at which Prof. R. P. Har-

ALL IN THE DAY'S WORK

A helicopter can easily hover low enough for pilot and passengers to talk with people on the ground nearby. The Kellett XR-8 helicopter, shown above, "stood still in the air" by the hour, at only *one foot altitude*, during its test period. When all was ready, restraining cables were loosed and its cross-country flying career began.

The XR-8 can fly forward, backward or sideways. It can rise or descend vertically, permitting take-offs and landings in any space large enough for safe clearance of its own blades.

Kellett has been active in the design of rotary wing aircraft—helicopters and autogiros—for over 16 years. More advanced models than the XR-8 are on Kellett drawingboards and in Kellett workshops today.

The final word in helicopter design will not be written for some time to come. Many engineering problems must be solved before helicopters are brought into practical daily use. Progress already achieved, however, more than justifies the man-hours that must still be spent by Kellett and other organizations active in this field. Their objective is to make helicopters available for exacting travel and transport jobs, in areas and under conditions where no other air, land or water craft can operate.

Kellett Aircraft Corp., Upper Darby (Philadelphia), Pennsylvania.

KELLETT

rington related his experiences on a trip to Europe made in connection with a special assignment for the Exploitation Division of Wright Field. Professor Harrington exhibited films of his trip to France and England.

Purdue University

At a meeting held on October 14 a talk titled "Hints to Men Entering Industry" was given by E. F. Bruhn, acting Head of the School of Aeronautics.

The following talks were given by members at a banquet held on October 21: "The Road Plane," by F. O. Kahl; "The Engineer and Psychology," by Lyle C. Crist; "German Superiority," by R. E. Bateman; and "Variable-Pitch Propellers," by G. W. Berryman.

Winner of the Scholastic Award was G. R. Telle and the Award for the best paper presented was won by Lyle C. Crist.

Spartan College of Aeronautical Engineering

On October 13 a business meeting was held at which five new members were enrolled. Plans were discussed for the participation of members of the Branch in athletics at the college.

Tri-State College

The first meeting of the current semester of the Tri-State College Branch was held on October 15. Officers elected were: Chairman, Walter Remy; Vice-Chairman, Robert L. Vaughn; Secretary-Treasurer, Don McKercher. Prof. Vern Jones continues as Faculty Adviser.

At a meeting on October 22, Professor Acton gave a talk on "Low Density Materials for Aircraft Construction."

On October 29, Student Council Representatives for the Fall term were elected. Joseph Sveda was elected Senior Representative and Richard Peterson, Junior Representative. The film *Wing Construction* was shown.

Virginia Polytechnic Institute

The Student Branch held a business meeting on October 9 at which new memberships and orientation were discussed.

At a meeting on October 23, the films *The Bell Helicopter* and *B-29's Over Dixie* were shown.

News of Members

Charles M. Adams has joined Republic Aviation Corporation as Major Layout Draftsman.

William R. Anderson is now Tool Engineer at Hupp Motor Car Company.

Sidney Baker has joined Chicago Mechanical Engineering Company as an Engineer.

Alvin M. Bialeck is now with Republic Aviation Corporation as an Aerodynamicist.

Allan F. Bonnalie, Assistant Vice-President in Charge of Operations of United Air Lines, Inc., has been appointed to the additional office of Director of the newly created Institute of Aeronautics at the University of Illinois.

Ben G. Bromberg is on leave of absence as Chief of Structures and Flight Test at the Allentown Division of Consolidated Vultee Aircraft Corporation, to engage in special research work at the Massachusetts Institute of Technology.

Ralph C. C. Brown is now with Canadair, Ltd., as Aeronautical Engineer.

Guy L. Bryan, Jr., now heads the Technical Department of the Engineering Division at The Glenn L. Martin Company,

Charles O. Cary, Executive Assistant to the Chairman of the Civil Aeronautics Board since 1944, has been promoted to the position of Special Assistant to the Board.

Julian J. Centye returned from service in the A.A.F. and is now with United Air Lines, Inc.

Robert A. Cornog has joined G. M. Giannini & Company, Inc., as Patent Engineer.

Thomas J. Cotton is now with the Aviation Gas Turbine Division of Westinghouse Electric Corporation.

Frederick Dallenbach has joined the Douglas Aircraft Company, Inc., as Engineering Designer A.

Donald W. Douglas, President of the Douglas Aircraft Company, Inc., has been appointed Chairman of the Industrial Division in the 1945 campaign of the Sister Kenny Foundation to raise funds for the Foundation's work in combatting infantile paralysis.

Mieczystaw W. Fangor is now Senior Stress Engineer at Fairchild Aircraft, Limited.

Clarence C. Flora has joined The Glenn L. Martin Company as Junior Aerodynamicist.

Thomas F. Francis is now with North American Aviation, Inc., as Engineering Test Pilot.

Jack Frye, President of Transcontinental & Western Air, Inc., has been appointed Chairman of the Aviation Division of the 1945 campaign for funds to support the work of the Sister Kenny Foundation against infantile paralysis.

Ernest F. Gamache has opened a personnel-service agency in New York known as Affiliated Personnel Associates.

Cedric B. Giles has been appointed Editor of the *Journal of the American Rocket Society.*

B. Allison Gillies, formerly Vice-President of Ryan Aeronautical Corporation, has been retained by the firm of Alvin P. Adams Associates to prepare analyses of aircraft production and other data for clients of the firm.

William H. Graham, Jr., has been promoted to the rank of Major in the Army Air Forces and is now Chief of the Civil Air Economy Division, Headquarters, U.S. Forces, China Theater.

Harold R. Harris has been elected Vice-President and General Manager of American Overseas Airlines, Inc., the transatlantic division of American Airlines System formerly known as American Export Airlines, Inc.

William S. Hazard is now a Design Engineer at Myers Aircraft Company.

Carl P. Heintze has engaged in business as an independent Engineering Consultant.

Jacque Houser is now with Boeing Aircraft Company as Assistant Group Engineer, Aerodynamics Unit.

Henry B. Howard has become Assistant Director at the British Ministry of Aircraft Production.

Leslie Hull has joined A. W. Hecker Company as Washington Representative.

William T. J. Hunter is now with Edo Aircraft Corporation as Structural Designer.

Robert P. Johnston has joined the Engineering Department of Beech Aircraft Corporation.

Harvey F. Jossen is now with J. P. Riddle Company as an Instructor.

Benjamin J. Kaganov has joined Edo Aircraft Corporation as Head of Structural Design.

Thomas N. Kelly has formed the engineering firm of T. N. Kelly & Company in Detroit.

George S. Knopf has become Project Aerodynamicist in the Experimental Engineering Division at Bendix Aviation Corporation.

Marck B. Komorn is now Manager at Select Plastic Products.

Grover Loening, who has served since 1942 as special consultant on aircraft to the War Production Board, the Navy Department, and the National Advisory Committee for Aeronautics, is leaving the Government service to return to private business and consulting work in the field. He will continue as an advisor to the N.A.C.A.

Loreto Lombardi has joined Pratt & Whitney Aircraft Division of United Aircraft Corporation as Class A Designer, Installation Development.

Thoburn C. Lyon has resigned as Chief Cartographic Engineer, Aeronautical Chart Branch, U.S. Coast and Geodetic Survey, to become Chief Cartographic Engineer with Aeronautical Services, Inc.

Alfred Marshall, former Vice-President of Lawrance Aeronautical Corporation, is now President of Coastalair, Inc.

James W. McGinness has joined Aero Transport Corporation as Foreman of Maintenance.

Ralph E. Middleton, a Vice-President of Aireon Manufacturing Corporation, has been named General Manager of the corporation's Hydraulics Division.

W. L. Jack Nelson has become President of Servair Aviation Corporation. He will serve also as Vice-President of Sewart Airport, Parkersburg, W.Va.

Oscar L. Olson, Jr., is now Structures Analyst at Beech Aircraft Corporation.

Nolan B. Orr has become Senior Engineer, Project and Design, at the Allison Division of General Motors Corporation.

Robert E. Owen has entered the Product Study Division of General Motors Corporation.

John G. Peine has joined the Bettendorf Company as Aeronautical Engineer.

Leonard C. Peskin has been elected Vice-President of Contracts at Kellett Aircraft Corporation. He was formerly Manager of the company's Contracts Division.

John H. Prentiss has had his name legally changed from John H. Prenzlau and has formed the firm of John H. Prentiss and Associates.

Robert Rautenstrauch is now an Associate Professor at the University of North Carolina.

Francis X. Rettenmeyer has joined the Federal Telephone and Radio Corporation as Chief Components Engineer.

Capt. Paul E. Richter, U.S. Naval Reserve, has returned from his naval duties and has assumed the post of Executive Vice-President of Transcontinental & Western Air, Inc.

Ernest W. Robischon has become Assistant to the Director, California Institute of Technology.

Harry J. Roffelsen has joined the Academy of Aeronautics, Inc., as Senior Engineering Instructor.

Fred T. Sarginson has become Aerodynamics Section Head at Frederic Flader, Inc.

John L. Senior, Jr., has joined Northeast Airlines, Inc., as Project Engineer.

Lt. Col. Nathaniel F. Silsbee has joined the Henry Publishing Company as Technical Editor of *Skyways* magazine, retaining his commission in the Air Corps Reserve.

Milton H. Slade is now a Layout Draftsman at Republic Aviation Corporation.

James H. Smith, Jr., recently returned from active duty as a Lieutenant Commander in the U.S. Navy, has been elected Assistant Vice-President of Pan American Airways, Inc.

Lester W. Smith has resumed his studies at Purdue University after serving with the A.A.F.

Richard H. Smith, Professor of Aeronautical Engineering at the Massachusetts Institute of Technology, is on leave of absence to make a survey of technical schools,

John C. Leslie has been elected Vice-President of Pan American World Airways, in charge of transatlantic operations. He was formerly manager of the company's Atlantic Division.

aircraft factories, and industrial laboratories in Brazil, at the invitation of the Brazilian Government. On September 7, in Rio de Janeiro, Professor Smith lectured before the Brazilian Institute of Aeronautical Sciences at its opening session. He was presented with an engraved plaque to commemorate the meeting, the first of its kind held in South America.

Rudolph Soellner is a partner in the new engineering firm of T. N. Kelly & Company in Detroit.

William G. Street was reported in the October issue of the AERONAUTICAL ENGINEERING REVIEW as having joined The Glenn L. Martin Company as Chief Flight Test Engineer. Mr. Street has joined the Aerodynamics Department of The Glenn L. Martin Company as Aerodynamicist. He was formerly Chief Flight Test Engineer at Consolidated Vultee Aircraft Corporation.

Cyrl W. Terry has joined the Faculty of Cornell University as Associate Professor of Aeronautical Engineering.

Gale E. Thompson is now a Designer at Douglas Aircraft Company, Inc.

Vernon G. Townsend has joined the Mechanical Division of General Mills, Inc., as Development Engineer.

Clarence M. Tyler is now with Republic Aviation Corporation as Stress Analyst.

Th. von Kármán, formerly Consultant on Aerodynamics and Structural Engineering at Northrop Aircraft, Inc., has assumed the post of Director, Scientific Advisory Group, in the Office of the Commanding General at Headquarters of the Army Air Forces at Washington.

Alexandros M. Voutsas was recently commissioned an Ensign in the U.S. Naval Reserve and is stationed at Moffett Field, Calif.

Herman C. Wieben, Jr., formerly Project Engineer, has become head of the Design Department at The Glenn L. Martin Company.

George T. Willey, formerly a Vice-President and General Manager of The Glenn L. Martin-Nebraska Company, has become Vice-President of Planning—Matériel at The Glenn L. Martin Company.

Raymond M. Wilson, formerly Manager of Wilson-Bonfils Flying School, is now President of Ray Wilson, Inc.

John P. Young has joined Pan American Airways System as Junior Pilot, after serving in the A.A.F.

Members Elected

The following applicants for membership or applicants for change of previous grades have been admitted since the publication of the list in the last issue of the REVIEW.

Elected to MEMBER Grade

Brumfield, Robert Clarence, Ph.D.; Research and Development Engineer, Aerojet Engineering Corp.

Cahill, Martin Blake, B.Ae.E.; Airline Captain, Northwest Airlines, Inc.

Chang, Shou Pao, B.S. in Ae.E.; Training Engineer, Consolidated Vultee Aircraft Corp.

Chen, Wan Ming, Training Engineer, Consolidated Vultee Aircraft Corp.

Cheng, Yu-Lin, B.S.; Engineer, Consolidated Vultee Aircraft Corp.

Civiello, Daniel P., Supervisor, Hamilton Standard Propellers Div., representing United Aircraft Corp. in Mid-West Area.

Cornish, Harry Ewing, Hydraulic and Landing Gear Group Engineer, El Segundo Div., Douglas Aircraft Co., Inc.

Cronk, Alfred Edward, B.S.; Instructor in Aeronautical Engineering, University of Minnesota.

Duncan, Richard Levi, B.S.; Lt. Comdr., Naval Aviator, U.S. Navy.

Fraser, Andrew Wauchope, Section Leader in Design Office, Scottish Aviation Ltd. (Scotland).

Guimaraes, Dirceu, Major, Representative, Brazilian Aeronautical Commission.

Haller, George Louis, Ph.D.; Col., U.S. Army Air Forces.

Hedrick, Ira Grant, C.E.; Structural Project Engineer, Grumman Aircraft Engineering Corp.

Heftler, Paul, LL.B.

Holmes, Gifford L., B.LL.; Patent Agent, United Aircraft Corp.

Howard, Henry Luther, Ch.E.; Sr. Stress Analyst, The Glenn L. Martin Co.

Katz, Sidney Leroy, Layout Engineer, Sikorsky Aircraft Div., United Aircraft Corp.

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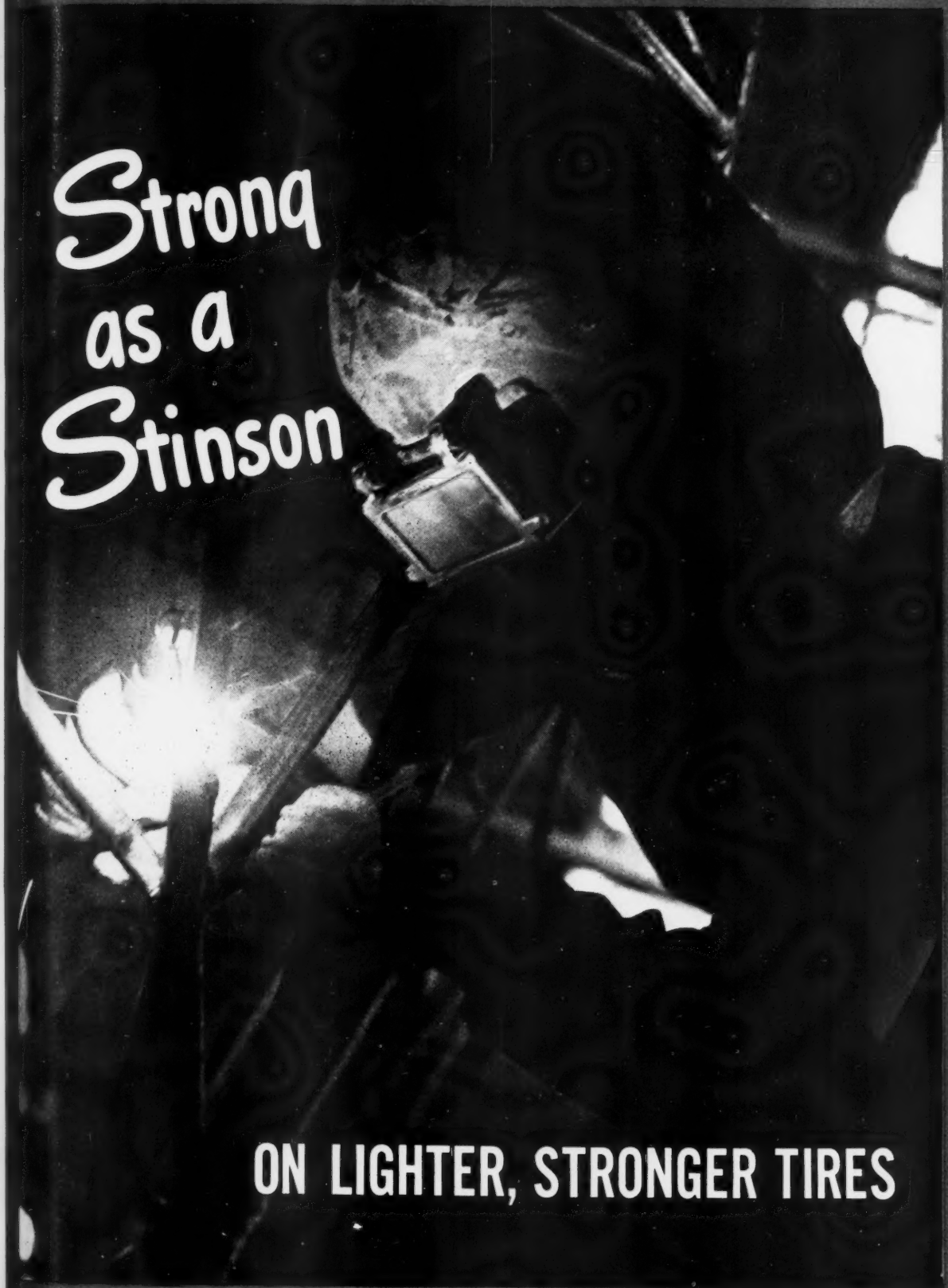

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1928 . . . One of a long line of firsts by Stinson airplanes, a "Detroiter" carried the first air mail to China. Later when this service was officially inaugurated, Stinson planes were used exclusively.

WORLD WAR II . . . The strength and stamina of the Stinson "Flying Jeep" along with its extreme maneuverability under battle conditions were dramatically demonstrated in World War II. For observation, liaison, hospital service and even as a super-light bomber, the Flying Jeep earned the honors of war.

Listen to "Science Looks Forward"— new series of talks by the great scientists of America— on the Philharmonic-Symphony Program, CBS network, Sunday afternoon, 3:00 to 4:30 E.S.T.

UNITED STATES

First Plane in 1926

STRENGTH, STABILITY, SECURITY

From its stalwart steel framework all the way through to its "mirror finish," the Voyager 150, product of Stinson Division of Consolidated Vultee Aircraft Corporation, is built to bring big airplane performance to the personal plane field. In the tradition of Stinson airplanes since the earliest Stinson plane of nearly twenty years ago, they are built strong and rugged to give luxurious security, ease of handling, and complete dependability. U.S. Royal Airplane tires, battle-tested on the Stinson "Flying Jeep," cushion their landings on every kind of flying field from pasture lot to modern airport.

TODAY . . . with the return of peacetime flying, Stinson announces the new Voyager 150. Powered with a Franklin 150 horsepower engine, the Voyager 150 will cruise at 125 m.p.h. over a 500 mile range. Its maximum speed will be 133 m.p.h. and its rate of climb 770 feet per minute. It carries a useful load of 944 pounds.

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Kiehl, Ralph Adam, Design Engineer, Consolidated Vultee Aircraft Corp.

Kossmann, Charles Edward, M.D. Sc.; Acting Director of Research, U.S. Army Air Forces School of Aviation Medicine.

Langhaar, Henry Louis, Ph.D.; Group Engineer, Structural Research, Consolidated Vultee Aircraft Corp.

Larrecq, Anthony James, B.S.; President, Associated Aeronautical Engineering & Research Corp.

McWhirter, Russell E., B.S. in M.E.; Lt. (j.g.), Flight Test Engineer, U.S. Navy.

Meidenbauer, Phillip Edward, Jr., Director, Oxygen Research & Development, Scott Aviation Corp.

Meyer, Charles Aloysius, B.S. in M.E.; Thermodynamics Section Engineer, Westinghouse Electric Corp.

Millington, Ernest, Sr. Examiner, Ministry of Aircraft Production (England).

Murthy, Holenarsipur Govindarao Srinivasa, B.E. in M.E.; Liaison Engineer, Hindustan Aircraft, Ltd. (India).

Nalle, Richard Tilghman, Jr., B.S. in M.E.; Capt., Test Pilot, U.S. Marine Corps Reserve.

Nicholson, Kennedy, Chief, U.S. Base Section, Aeronautical Chart Branch, U.S. Coast and Geodetic Survey.

Null, Fay Edison, Ph.D.; Electrical Engineer, U.S. Army Air Forces (Wright Field).

Ours, Statton Ray, Ae.E.; Comdr., Asst. Head, Structures, Bureau of Aeronautics, U.S. Navy Dept.

Purcell, William Lawrence, Lt. Col., Air Corps, A.A.F., Sr. Plant Representative, Curtiss Propeller Div., Curtiss-Wright Corp.

Rebello, Fernando, Asst. Chief of Engineers, Fábrica do Galeao, Air Ministry (Brazil).

Roy, Maurice Paul, Dr. Sc.; Prof., Thermodynamics and Thermical Engines, École Nationale Des Ponts Et Chaussées (France).

Schwartzman, Jack, B.M.E.; Salvage Engineer, Fairchild Aircraft, Ltd. (Canada).

Smyth, Leo Sidney William, F/Lt., Engineer Officer, Royal Australian Air Force (Australia).

Swartzel, Karl Dale, A.B.; Asst. Chief, Physics Dept., Research Lab., Curtiss-Wright Corp.

Townsend, Neville Austin, M.E.; Asst. Chief of Stress, Helliwells Ltd. (England).

Truettner, Lawrence Hess, M.S.E.; Aeronautical Engineer, Air Technical Service Command, U.S. Army Air Forces (Wright Field).

Wells, James Robert, Inspection Supervisor, Boeing Aircraft Co.

Wilkins, Robert Edwin, Inspector in Charge, British Air Commission (Washington, D.C.).

Willis, Clifford Edmund, Sr. Development Engineer, The Weatherhead Co.

Wislicenus, George Friedrich, Ph. D.; Compressor Research Engineer, Packard Motor Car Co.

Wold, William Clifford, B.S. in Ae.E.; Executive Assistant, Consolidated Vultee Aircraft Corp.

Wood, Donald Crawford, Sr. Technician (Aerodynamics), A. V. Roe & Co., Ltd. (England).

Elected to Industrial Member Grade

Gallagher, Gerard Aloysius, A.B.; Supt. Field Operations, Fleetwings Div., Kaiser Cargo, Inc.

Payne, John Howard, B.S. in E.E.; Export Manager, Aircraft Industries Assoc.

Pochy, Jerry, Field Service Representative, McDonnell Aircraft Corp.

Price, John Francis, Supervisor, Installation Drafting and Data Section, Wright Aeronautical Corp.

Thornton, James Edward Sherman, General Foreman, Experimental Dept., The de Havilland Aircraft of Canada, Ltd. (Canada).

Elected to Technical Member Grade

Boyer, Luther John, B.S. in M.E.; Pvt., Flight Test Analyst, U.S. Army Air Forces.

Brewer, Roger Paul, B.S. in Ae.E.; Sr. Engineering Draftsman, Goodyear Aircraft Corp.

Burdett, Harry Warren, Design Engineer, Reaction Motors.

Cassidy, James Felix, Schedules Supervisor, Canadair, Ltd. (Canada).

Cherry, Horace Heston, B.S. in Ae.E.; Capt., U.S. Army Air Forces.

Clements, Francis Peter, Material Coordinator, Pan American Airways, Inc.

Dowell, Eugene Harris, B.Sc., B.E.

Emery, Donald Kenneth, Instructor-at-large, Air Transport Command, U.S. Army Air Forces.

Ferguson, Archibald John, Aircraft and Engines Inspector, British Overseas Airways Corp. (South Africa).

Frissel, Harry Frederick, M.S.; Flutter and Vibration Engineer, Curtiss-Wright Corp.

Holmes, James Makepeace, Lt., U.S. Army Air Corps Reserve.

Hwang, Chen Ya, Engineer Trainee, Consolidated Vultee Aircraft Corp.

Li, Chao Peh, B.S.; Engineer, Consolidated Vultee Aircraft Corp.

Li, Ting Yi, B.S. in Ae.E.; Engineer, Consolidated Vultee Aircraft Corp.

Lucas, Thomas Earl, Field Service Engineer, Sperry Gyroscope Co., Inc.

Ma, En Chun, B.S. in Ae.E.; Engineer, Consolidated Vultee Aircraft Corp.

Mallon, Clarence Richard.

Merkin, Eugene, B.Ae.E.; Stress Analyst, Republic Aviation Corp.

Pence, Robert Forrest, B.S. in M.E.; Stress Analyst, Consolidated Vultee Aircraft Corp.

Shen, Polin, B.S.; Engineer, Consolidated Vultee Aircraft Corp.

Silver, Jack Harry, Associate Aeronautical Engineer, U.S. Navy.

Townsend, Thomas Hewell, Jr., B.S. in M.E.

Weiss, Harry H. Jr., A.B.; Adm. Clerk, Maintenance Dept., Pan American Airways System.

Transferred from Student to Technical Member

Adise, Herbert Howard, B.Ae.E.; Aero. Engineer, Langley Mem. Aero. Lab., N.A.C.A.

Berlage, Thomas Nicholas, Jr., B.S.; Jr. Aero. Engineer, Research Div., United Aircraft Corp.

Brenner, Harry Samuel, B.Ae.E.; Aeronautical Engineer, Bur. of Aeronautics, U.S. Navy Dept.

Drumheller, Kirk, S.B.; U.S. Navy.

Dvorak, George Robert, B.S. in Ae.E.; Jr. Engineer, Boeing Aircraft Co.

Justiniano G. Hernon, B.S. in Ae.E.; Capt., U.S. Army Air Forces.

Koch, Warren Beverstock, B.S. in Ae.E.; Jr. Stress Analyst, The Glenn L. Martin Co.

Knowles, James Alden, B.S. in Ae.E.; Ensign, U.S.N.R.

LaValle, Albert Placido, B.Ae.E.; Aerodynamicist, Grade B., Edo Aircraft Corp.

Leone, Peter, Engineer, The Glenn L. Martin Co.

Lohman, Robert Lansing, B.S. in Ae.E.; Asst. Engineer, American Airlines, Inc.

Rubin, Eugene Sumner, B.S. in Ae.E.; Ensign, U.S. Navy.

Smietanski, Richard Bruno, B.S. in Ae.E.

Van Vooren, George Robert, Master Layout Draftsman, The Glenn L. Martin Co.

Wilfahrt, Donald Charles, B.Ae.E.; Ensign, U.S. Navy.

Elected to Affiliate Grade

Belluomini, Julius John, Foreman, Sacramento Air Service Command.

Gudaitis, Frank August, Cathode Ray Equipment Technician, Reiner Electronics Corp.

Necrology

Edward Goodman Sperry

Edward Goodman Sperry, Vice-President of Sperry Products, Inc., and a Member of the Institute, died on November 6 at the North Country Community Hospital, Glen Cove, L.I.

Mr. Sperry was born in Chicago on January 2, 1893, and received his degree in Mechanical Engineering from Cornell University in 1915. He then joined the Engineering Department of Sperry Gyroscope Company, Inc., where he was engaged in the design of its early ship stabilizers and later had sole charge of their installation on submarines, destroyers, and a 10,000-ton marine transport. In 1929 he helped organize Sperry Products, Inc. This firm has since been engaged in extensive instrument research and development.

Mr. Sperry together with his sister, Helen Sperry Lea, and his brother, Elmer A. Sperry, Jr., provided a fund for the establishment of The Lawrence Sperry Award, in memory of their brother. This award is presented each

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year by the Institute "for a notable contribution made by a young man to the advancement of aeronautics."

Squadron Leader Charles Gordon Bull

Squadron Leader Charles Gordon Bull, Royal Canadian Air Force, a Technical Member of the Institute, was killed when his plane was crippled by antiaircraft fire while on a mission over France on July 18, 1944. He was stationed at Croft, England.

Born in Nipigon, Ontario, on May 3, 1913, Squadron Leader Bull received a First Class Teacher's Certificate from the North Bay Normal School in 1933. In 1939, he received the Degree of Bachelor of Science in Mechanical Engineering from Purdue University, where he majored in airplane design and airplane engine design.

Personnel Opportunities

This column is for the use of individual members of the Institute seeking new connections and organizations offering employment to aeronautical specialists. Any member or organization may have requirements listed without charge by writing to the Secretary of the Institute.

WANTED

Design Engineers; Draftsmen—Opportunities now exist for qualified design engineers and draftsmen for work on the new stratocruiser C-97 military transport and other new developments. Here is an opportunity to become associated with one of the world's leaders in aircraft design and production and to participate in the design of the aircraft of tomorrow. Address inquiries to Harold Mansfield, Public Relations Manager, Boeing Aircraft Company, Seattle, Wash.

Aerodynamicists and Thermodynamicists—Research minded and with good theoretical background, to engage in research work on high-speed and jet propulsion developments, advanced degrees preferred. Salary commensurate to qualifications. Replies will be held in strict confidence. Write, giving education and experience, to Curtiss-Wright Corporation, Research Laboratory, Buffalo, N.Y.

Aeronautical Engineering Professor to teach Airplane Design, Airplane Structure, and related subjects. Applicants required to have a degree in aeronautical engineering as well as practical experience in the field. Preference given to candidates having advanced degrees. Facilities now under construction and plans for future construction will provide ample opportunity for research, development, and consultation. Rank and salary will depend upon training and experience of applicant. In applying please give brief sketch of personal qualifications, education, and experience. Address reply to Prof. Robert M. Pinkerton, Department of Aeronautical Engineering, A. & M. College of Texas, College Station, Texas.

Aerodynamicists, Stress Analysts, Design Engineers, Detail, and Layout Draftsmen needed for development work on new experimental Military and Commercial model airplanes as well as other related projects of a "Confidential" nature. Curtiss-Wright has several excellent opportunities for qualified personnel. Address inquiries to Curtiss-Wright Corp., Airplane Division, Buffalo, N.Y., Attention: G. A. Page, Director of Engineering.

Aircraft Engineers—Immediate, permanent openings for aircraft engineers with 5 years' experience in aerodynamics, structural design, and C.A.A. airworthiness requirements with Southern California aircraft manufacturer. Air-mail qualifications and recent photo to P.O. Box 29, Burbank, Calif.

Detail and Layout Engineers, Stress Analysts, Aerodynamicists, and Design Engineers—For development work and production engineering work in Engineering Division. Call in person or write to Chief Administrative Engineer, Boeing Airplane Company, Wichita, Kan.

Radio, Electronic and Telephone Engineers, Electronic and Mechanical Draftsmen—One of the largest manufacturers of a wide variety of electronic and communications equipment in the world is fully prepared and ready with an ambitious postwar program. Write to Personnel Manager, Federal Telephone & Radio Corp., 591 Broad Street, Newark, N.J.

Aeronautical Engineer—To teach Senior year subjects of aeronautical engineering course including design and stress analysis. Address inquiries to The Aeronautical University, Inc., 116 South Michigan Avenue, Chicago, Ill.

Aircraft Stress Engineers thoroughly familiar with the analysis of aircraft structures, aircraft controls, and all component parts for work on helicopters. Excellent opportunities for personnel interested in rotary-wing aircraft. Apply by letter, giving references, to Administrative Engineer, Kellett Aircraft Corporation, Plant #2, Lansdowne Avenue above State Road, Upper Darby, Pa.

Personnel Needed—Executive and Administrative experience in manufacture of aircraft. Positions available in several fields; Factory and Production Management, Matériel, Tooling and Engineering. McDonnell Aircraft Corporation, Ambassador Building, St. Louis 1, Mo.

Aeronautical Engineers—for immediate work, the long-established Aeronca Aircraft Corporation seeks project engineers, design engineers, weight engineers, and layout draftsmen. These positions offer unusual permanent opportunities with the pioneer light-plane company of America for qualified men. Write in complete detail to Aeronca Aircraft Corporation, Box 00, Middletown, Ohio.

General Manager—A medium-sized aircraft company has opening for man qualified to direct manufacturing, sales, quality, personnel, accounting, and engineering functions. Must have long experience in management and good education. Company working on Government contracts, commercial aircraft production, and other manufacturing. Address inquiries to Box 410, Institute of the Aeronautical Sciences.

Research Fellows—To work half time on industrial research programs and study half time for M.S. or Ph.D. degree. Salary $1080 for 12 months together with freedom from tuition fees. Extra compensation during summer months may be obtained by working full time. Address inquiries to Box 398, Institute of the Aeronautical Sciences.

Research Engineer—To work on industrial research program. Electrical, mechanical, or civil engineering degree and some experience in materials-testing and vibration theory desirable. Salary $2600 or more depending on experience. Address inquiries to Box 397, Institute of the Aeronautical Sciences.

Engineer of Tests—To take charge of commercial and industrial structures and materials tests. M.S. degree and laboratory experience desirable. Opportunity to work for doctorate. Salary $3000 or more for 12 months depending on experience. One month vacation with pay. Address inquiries to Box 396, Institute of the Aeronautical Sciences.

Project Engineer—Experienced and talented design man to undertake the responsibility for a new aircraft project from inception to completion. Plant located on eastern seaboard. Salary scale above average. Write full particulars. Address inquiries to Box 370, Institute of the Aeronautical Sciences.

Works Manager—Manufacturing executive to set up and operate a production program on a new aircraft.

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Airplane Salesmen—Large established producer of personal aircraft seeking several qualified airplane salesmen with both flying and merchandising experience. Interview in New York. Address inquiries to Box 362, Institute of the Aeronautical Sciences.

Assistant Sales Manager—Large established producer of personal aircraft seeking qualified assistant sales manager. Interview in New York. Salary commensurate with ability. All replies treated confidentially. Address inquiries to Box 361, Institute of the Aeronautical Sciences.

Associate Professor of Aircraft Structures—To teach senior and graduate courses in aircraft structural theory, develop structures laboratory, and direct graduate structural research work. Practical experience necessary. Advanced degrees preferred. Permanent position. Leading State University. Location—Midwest. Address inquiries to Box 340, Institute of the Aeronautical Sciences.

Associate or Full Professor: To teach advanced courses and direct research in the Aircraft Power Plant Design field. Recent experience in turbine and jet engine design and testing necessary. Advanced degrees preferred. Permanent position, large mid-western university. Can wait six months if necessary. Address inquiries to Box 339, Institute of the Aeronautical Sciences.

Assistant or Associate Professor of Aerodynamics—Young man with Ph.D. to teach graduate courses in theoretical aerodynamics and direct theoretical and experimental research in this field. Research experience necessary. Position permanent. Mid-western State University. Address inquiries to Box 338, Institute of the Aeronautical Sciences.

Associate or Professor of Aerodynamics—To teach performance, control, stability and develop correlating flight test and flight instrumentation courses for large mid-western university. Position permanent. Practical experience necessary. Advanced degrees preferred. Address inquiries to Box 337, Institute of the Aeronautical Sciences.

Patent Engineer—Familiar with patent disclosures and procedures. Essential helicopter industry. Salary commensurate with experience and present earning capacity. Address inquiries to Box 322, Institute of the Aeronautical Sciences.

Assistant Professor—To teach Mechanics, Strength of Materials, and Physics in a small Mid-western College. Must have Master of Science Degree, preferably in Engineering or Physics. Salary dependent on qualifications and experience. Position permanent. Address inquiries to Box 291, Institute of the Aeronautical Sciences.

AVAILABLE

Aeronautical Engineer—28 years old. Four years' experience. Speaks French, German, and some Spanish. Desires position calling for such qualifications; not necessarily pure engineering. Address inquiries to Box 409, Institute of the Aeronautical Sciences.

Aeronautical Engineer—B.Ae.E. from University of Minnesota. Specialized in aerodynamics, airplane design, and stress analysis while in college. Eighteen months' experience in maintenance of wood, metal, and single- and twin-engined aircraft. Desires full-time position leading to work in aerodynamics or airplane design. Address inquiries to Box 407, Institute of the Aeronautical Sciences.

Aeronautical Engineer—B.S.Ae.E., and C.A.A. Aircraft Mechanic Certificate. Experience consists of seven months in aircraft manufacture while attending college, and two years, since graduating from college, in maintenance and design engineering on four-engined transports for commercial airline. Interested in position with another air line, manufacturer's field service technical representative, or similar work. Any location considered. Address inquiries to Box 406, Institute of the Aeronautical Sciences.

Aeronautical Engineer (native Russian)—Would like to translate Russian scientific and technical papers. Thoroughly acquainted with the field of theoretical and applied aerodynamics. Address inquiries to Box 405, Institute of the Aeronautical Sciences.

Aeronautical and Mechanical Engineer—B.S., S.M. Broad experience in theoretical and experimental stress analysis, vibration theory, and instrumentation. Project organization and customer liaison work. Long residence in the Orient. Speaks and writes Russian fluently; some French and Chinese. Interested in responsible position with consulting firm or similar organization having foreign contacts. Address inquiries to Box 404, Institute of the Aeronautical Sciences.

Aeronautical Engineer—M.S. in Ae. and Me.E., 1924. Research, Preliminary design, Development. Past experience includes: Consulting Engineering (research, coordination of new developments); Project Engineer, Aerodynamics Engineer, Research Engineer. Inventive; Analytical mind. High references. Prefers location in United States or Canada. Address inquiries to Box 402, Institute of the Aeronautical Sciences.

Aeronautical Engineer—B.A.E. One and one-half years' aeronautical research experience; plus 3 years' experience in structures, drafting, liaison, production expediting for large aircraft corporation. Desires design or production management position with aircraft manufacturer. Address inquiries to Box 401, Institute of the Aeronautical Sciences.

Development Engineer—Aeronautical engineering degree, industrial management training. Five years' experience in aircraft engine design and research aircraft production, editing. Ideal assistant for busy executive. Will conduct correspondence and technical writing, assist in project administration, planning and coordination, or handle strictly technical assignment. Address inquiries to Box 400, Institute of the Aeronautical Sciences.

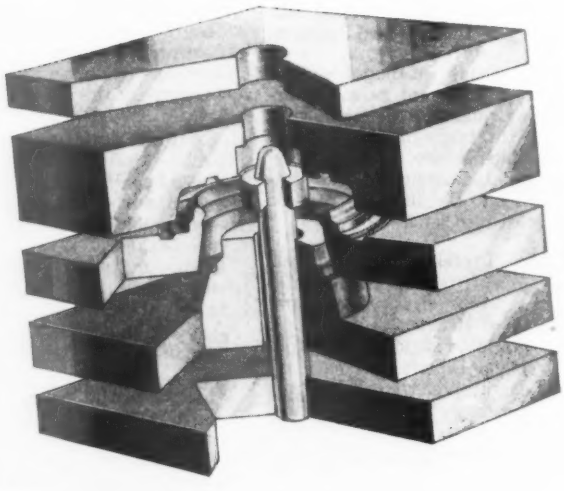
Hydraulic Service Engineer—One year at Purdue University; one year at Indiana University Extension. Graduated from Aviation Mechanical School, Curtiss-Wright Tech., Glendale, Calif., with high scholastic honors. Approximately six years' experience in aircraft hydraulics as teacher, designer, mechanic, and school supervisor. Taught and supervised aircraft hydraulics at Curtiss-Wright Tech. Established, taught, and supervised aircraft hydraulics at Utah State College at Logan, Utah. During the past 3 years, while in the Navy, has been assigned to duty as hydraulic supervisor and established one of the largest aircraft hydraulic schools in the country. During these 3 years has also designed and constructed hydraulic valves, fittings, test benches, and mock-ups for Navy use. Possesses a C.A.A. airplane mechanic certificate. Mechanical background: welder, lathe operator, riveter, etc. Address inquiries to Box 399, Institute of the Aeronautical Sciences.

Test Pilot—B.S. in A.E., Oregon State College. Five years of Navy flying, including Instructor in single and multiengine aircraft: 1,000 hours four-engine time; 1,000 hours twin-engine time; 2,800 hours total. Thirteen months of Aleutian flying, Navy Maintenance Officer, Weight and Balance. Holds commercial, instrument, and radio licenses. Desires engineering test with foreign or domestic company. Address inquiries to Box 395, Institute of the Aeronautical Sciences.

Mechanical-Aeronautical Engineer—B.S. in M.E., University of Michigan. Seventeen years' experience with aircraft manufacturers, air lines, and aircraft maintenance equipment manufacturer. Designed and patented manufacturing and maintenance equipment now used extensively in the industry. Held responsible positions in development, design, sales and management. Broad general experience in most phases of the aeronautical industry throughout the United States. Desires executive position with an air

"SIMPLE" PARTS often demand COMPLEX MOLDS

The relatively "simple" rubber-to-metal part indicated by the cross-sectional drawing above requires the complex, multiple-cavity mold illustrated at the right.



The "simple" rubber-to-metal part is not necessarily free of complications in producing it. As the above example illustrates, an intricate, multiple-cavity mold is required to produce the part that looks so "simple."

First consideration is the combination of conditions under which the finished part is to function. Next comes the design and manufacture of the mold to produce it. Then the correct compound of rubber or rubber-like material must be determined to meet both the molding and functional requirements. Exceptional precautions must be taken to prevent heat expansion from causing variations in the mold cavities, and often the mold cavities have to be registered individually with each other. Those and other related problems must be brought into "harmony" by modern techniques of the rubber industry. Briefly, it is a combination of "know-how" factors available here at "ORCO" that is causing an unprecedented demand for our services from a wide diversity of industries.

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line or allied industry manufacturing aircraft, aircraft equipment, or maintenance equipment for the air lines. At present is a naval officer on air-transport engineering duty. Expects to be released to inactive duty in January, 1946. Address inquiries to Box 394, Institute of the Aeronautical Sciences.

Aeronautical Engineer—University Michigan graduate with 20 years' design and executive experience, desires responsible position with aircraft manufacturing, aircraft accessory, or air-line organization. Experienced on Army, Navy, and C.A.A. Requirements. Address inquiries to Box 393, Institute of the Aeronautical Sciences.

Project Engineer—B.S. in M.E., Aero. E. Thirty-five years old. Over 10 years of aircraft design, structural layout and administrative duties. Seven and one-half years of supervisory experience in engineering, seeking executive or supervisory position, not necessarily in aviation. Location open. Address inquiries to Box 392, Institute of the Aeronautical Sciences.

Aeronautical Engineer—B.S. Aero Eng., New York University, 30 years old, married. Eight years' experience in design and design supervision as Group Leader and Assistant Project Engineer for various prime contractors of military aircraft. Complete and varied experience in all phases of aircraft design, including structural, power-plant installation, controls, armament, equipment, hydraulics, etc. Also shop experience, engineering shop contact, flight-test, and general administrative experience. Responsible position in any field considered. Location on East Coast preferred, but not essential. Address inquiries to Box 391, Institute of the Aeronautical Sciences.

Design Engineer—Available on fixed basis for specific designs of aeronautical, structural or mechanical nature. For detail qualifications address inquiries to Box 390, Institute of the Aeronautical Sciences.

Aeronautical Engineer and Pilot—Graduate Aeronautical Engineer with $2^1/_2$ years in Army Air Forces, including "Aircraft Maintenance Engineering" course at Yale University and A.A.F. pilot training. C.A.A. Commercial Pilot and Ground Instructor. Desires position with flying school or engineering division of air line. Willing to work in foreign country. Address inquiries to Box 389, Institute of the Aeronautical Sciences.

Aerodynamicist and Physicist—B.S. in E. E.; M.S. in Applied Physics; $1^1/_2$ years' Doctorate work in Applied Science. Seven years' teaching experience in university—Aerodynamics, Physics, Fluid Mechanics, and allied subjects including graduate level. Five years' experience as Aerodynamicist, Propeller Designer, and Stress Analyst. Prefers university position with research and consulting possibilities and a possibility of completing Doctorate, or responsible industrial position with good chances for advancement within commuting distance from approved graduate engineering or science college. Address inquiries to Box 388, Institute of the Aeronautical Sciences.

Technical Administration or Technical Sales—Over 20 years of aircraft experience which has covered airplane project design followed by ten years of technical administration work in the top management of two large airplane companies. Wishes responsible position in connection with technical sales. Address inquiries to Box 387, Institute of the Aeronautical Sciences.

Engineer–Executive—Twelve years' experience includes airplane design, stress analysis, and structures. Director of Aeronautical Engineering and Sales in aircraft accessories field. Wide acquaintance in the industry, including manufacturers, air lines, aircraft distributors, A.A.F., and Navy Bureau of Aeronautics. University graduate and professional aeronautical engineer. Seeks permanent connection as a key personnel in design, executive, or sales engineering, or as manager in the aviation department or technical adviser in nonaviation industry. Development and experimental work welcome. Address inquiries to Box 386, Institute of the Aeronautical Sciences.

Administrative Engineer—Graduate engineer with over 15 years' experience in design, research, and manufacturing. Eight years' experience in the administration of a division of engineering of a well known aircraft company. Desires a position of responsibility with a medium sized company that has good prospects for future advancement. Address inquiries to Box 385, Institute of the Aeronautical Sciences.

Engineer—B.S. in Aeronautical Engineering, licensed airplane mechanic, four years' experience. One year on aircraft design and development. Three years as research engineer on aircraft and other types of internal combustion engines. Chinese with good knowledge of language. Desires a responsible position in China in engineering, engineering sales, or as a technical representative in the aviation, oil, or automotive industry. Excellent references. Address inquiries to Box 384, Institute of the Aeronautical Sciences.

Aeronautical Engineer—B.S. in Ae.E. (Mexican Citizen) Speaks and writes Spanish. Desires position with a small company with good opportunities for advancement. Any location in the United States would be considered. Would also consider a position in Mexico as a representative of a company with business relations in this country. Address inquiries to Box 383, Institute of the Aeronautical Sciences.

Structures Engineer—B.S. in Aero. Engineering. Five and one-half years stress experience with the Development Engineering Department of a large Aircraft Corp. Desires responsible position in the Los Angeles area. Address inquiries to Box 382, Institute of the Aeronautical Sciences.

Aeronautical Engineer—Ae.E. Two years' experience as Foreman in Charge of Spinning Aircraft Fabrics, two years in Hydraulics and Contact Work, three-and-one-half years as Design Engineer in Aircraft Turret Work, including Design and Layout Work in Armament. Desires position as Sales Engineer or Project Development work. West Coast or Midwest location preferred. Will accept work in Foreign Country. No objection to traveling. Available immediately. Address inquiries to Box 381, Institute of the Aeronautical Sciences.

Aeronautical Engineer—with own design of helicopter having two coaxially counterrotating lift rotors seeks connection with Aircraft Manufacturer. Thirty years' total professional experience including 15 years airplane, and 2 years helicopter design and development. Address inquiries to Box 380, Institute of the Aeronautical Sciences.

Electrical Engineer—B.S. in E.E., M.S. in E.E., four years' experience coordinating research and development programs aircraft electrical systems. Ten years' design and manufacture electrical equipment. Desires technical administrative position with electrical manufacturer specializing in aircraft. Address inquiries to Box 379, Institute of the Aeronautical Sciences.

Quality Control Manager, Chief Inspector—Eighteen years' aircraft experience. Excellent references. Army or Navy work preferred. Location East Coast. Address inquiries to Box 378, Institute of the Aeronautical Sciences.

Mechanical and Aeronautical Engineer—B.S. in M.E., Aeronautical Engineering Option, 1936. Candidate for M.S. degree in Mechanical Engineering with graduate work to be completed during first year after release from active duty. Two years' experience Machine Tool Design and Drafting; three and one-half years' experience in Aircraft Propeller Design and Vibration Research; one-half year experience in Aeronautical Research; thirty-nine months' service as officer in Army Air Forces Air Technical Service Command's Engineering Division Laboratories and Central District as Project Officer. Highest references. Location near New York City preferred. Address inquiries to Box 376, Institute of the Aeronautical Sciences.

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THE ease with which the new Martin model 202 transport can be refueled and serviced means more than shorter stops and faster passenger schedules. It also means a lot of time and trouble saved by those unsung heroes of the air lines, the hard-working maintenance men. Unusual accessibility, rugged long-lasting construction, and emphasis on interchangeability of parts—these features make the Martin 202 the easiest plane of its type to service and maintain. Look at the facts listed below and you'll see why the 202 is the answer to a maintenance man's prayer!

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FACTS FOR MAINTENANCE MEN ABOUT THE NEW MARTIN 202!

- Radio, heating and electrical equipment, as well as control cables and hydraulic lines, all are located in the belly of the fuselage—are accessible through large "bomb-bay" type doors. Equipment is grouped to permit work on separate types with minimum of interference.
- Accessories at rear of engines are accessible from wheel-well through removable panel on fire wall. The 202 also permits under wing pressure fueling—oil tank servicing from ground. Adequate, quick-opening panels permit inspection of vital controls.
- Pilot's and co-pilot's flight group instruments removable as unit through nose wheel-well from back of instrument panel. Three-point suspension tubular engine mount is designed for maximum accessibility to engine.
- Flexible Mareng fuel cells, easily removed, installed or repaired. Cabin furnishings easily removable without tools.
- Special attention given to making all parts interchangeable. Wherever possible right and left hand parts are identical. Thus, for example, soundproofing consists of identical interchangeable panels, easily removed or installed without tools.
- Power plant mountings are designed for rapid replacement, right and left engines are interchangeable, cowlings are easily removed. Flexible, long-lasting, fireproof tubing for all fuel lines forward of firewall are specified.
- Landing gear consists of dual main wheels which are safer, lighter to handle, easily replaced—and a new style nose wheel which eliminates the complexity of the dual-sealed-tube type. Convenient jack pads permit easy replacement of wheels and brakes—down-and-up lock arrangement is simplified, reliable.
- These are only a few of the outstanding features of the Martin 202. From stem to stern this plane was designed to meet airline maintenance requirements as determined by long study of airline custom and procedure.

- The Martin 202 is engineered specifically to meet Air Transport Association specifications. Not just designed for the airline but *by* the airline—custom-built by Martin—to the most exacting standards of the air traveler.

Development Engineer—Graduate Engineer, B.S. in Ae.E., with 6½ years of aircraft and machine design experience, including design of and fabrication contact for varied mechanisms, landing gears, and hydraulic units. Location in Eastern district preferred. Particularly interested in smaller company with expanding post-war plans, in which advancement is possible along with the company. Address inquiries to Box 375, Institute of the Aeronautical Sciences.

Stress Analyst, Design and Development Engineer—B.S. in aeronautical engineering; five years' experience in aeronautical engineering after graduation. Structural design and analysis experience with large manufacturer of military landplanes and seaplanes. More than two years' work in the investigation and development of new structural materials and types of construction including magnesium, plastics, sandwich construction. Experience in latest structural test methods; one-and-a-half years' experience as design project officer in Bureau of Aeronautics with engineering cognizance over production and experimental models. Desires permanent position as assistant design project engineer or as structures analytical or test engineer with East or West coast manufacturer. Address inquiries to Box 374, Institute of the Aeronautical Sciences.

Engineer, Development or Chief—Over 25 years on airplane design, accessories development, operations engineering, technical writing, and executive work. Wide experience with all types of materials; inventive and possessing initiative. Recent salary $7,500, but will consider proposition. Eastern part of U.S. preferred but not essential. Address inquiries to Box 372, Institute of the Aeronautical Sciences.

Jet Propulsion Engineer—M.E., M.S. Worked with rockets several years before Pearl Harbor. Asst. Director of Research of O.S.R.D. laboratory where bazooka was developed. Desires contact arms, airplane, or engine manufacturers, and others interested in setting up an independent jet propulsion research laboratory for developing rockets, jets, athodyds. Address inquiries to Box 371, Institute of the Aeronautical Sciences.

Director of Flight Training—Ranking Naval Officer available soon, desires position as Director of Flight Training Program for progressive University. Ten years' teaching, 24 years' aviation. Mechanics, Flight, and Ground Instructor ratings. Organization and operating experience. Address inquiries to Box 368, Institute of the Aeronautical Sciences.

Air-Line Service Engineer—B.S. in Aero. Eng. Over five years with major air line specializing in service problems on some trainers and most types of air transport aircraft. Experienced in troubleshooting, establishing service procedures, etc. Has supervised engineering projects. Desires similar position with small air line or aircraft manufacturer. Address inquiries to Box 367, Institute of the Aeronautical Sciences.

Aeronautical and Structural Engineers—Recently formed engineering organization is interested in contacting aircraft manufacturers in southern California for engineering of entire airplanes or major components. Will assume full responsibility for stress analyses and C.A.A. negotiations. All members of this group have held responsible aeronautical engineering positions in both small and large companies during the last 10 years. Address inquiries to Box 366, Institute of the Aeronautical Sciences.

Gear Expert and Mechanical Engineer—Also has considerable aeronautical experience. Fine leadership qualities coupled with analytical mind. M.I.T. graduate. Age 31. Desires responsible position with consulting firm or other organization. Address inquiries to Box 365, Institute of the Aeronautical Sciences.

Administrative Engineer—B.S. in A.E. from University of Michigan. Graduate of Civilian Pilot Training and possesses civilian pilot's license. Also holds an Aircraft Mechanic Certificate. Graduate of an accelerated course in Maintenance Engineering at Yale University. At present Administrative Officer assigned to an Aircraft Maintenance Unit, A.A.F. Would prefer employment by a commercial air line. Will be available within the next four months. Address inquiries to Box 364, Institute of the Aeronautical Sciences.

Engineer—Aeronautical Graduate. Familiar with research of transport aircraft and technical writing. Manufacturing and air-line experience, maintenance and operations. Administrative, writing, and sales ability. Desires position in engineering sales writing or as a technical consultant for aviation or nonaviation industry. Address inquiries to Box 363, Institute of the Aeronautical Sciences.

Aeronautical Engineer—Ten years' experience teaching aeronautics and allied subjects. At present employed by Navy Department in aerodynamic analyses of military aircraft, including considerable work in jet propelled types. Desires a teaching position in the south or southwest by winter or spring term. Address inquiries to Box 358, Institute of the Aeronautical Sciences.

Engineering Service and Sales Representative—Engineering Degree, total of 10 years' aircraft design, accessory and sales engineering, hydraulic and control equipment experience. Extensive contacts, services, aircraft plants, industrial and marine field. Seeking position in engineering or engineering sales or as technical representative in aviation or allied field. Address inquiries to Box 357, Institute of the Aeronautical Sciences.

Aeronautical Equipment and Sales Engineer—Graduate engineer with 14 years' experience in civil and military aviation specializing in the sales and service of aircraft instruments and equipment. Recently released from active service in the Army Air Forces after 6 years devoted largely to pilot training and aircraft and equipment testing. Over 5,000 hours as pilot in military and civil aircraft. Interested in position offering executive responsibilities in the interest of sales and service within this country or abroad. Will consider any position where a broad background in aviation development, initiative, responsibility can be employed. Available for immediate employment. Excellent references. Address inquiries to Box 356, Institute of the Aeronautical Sciences.

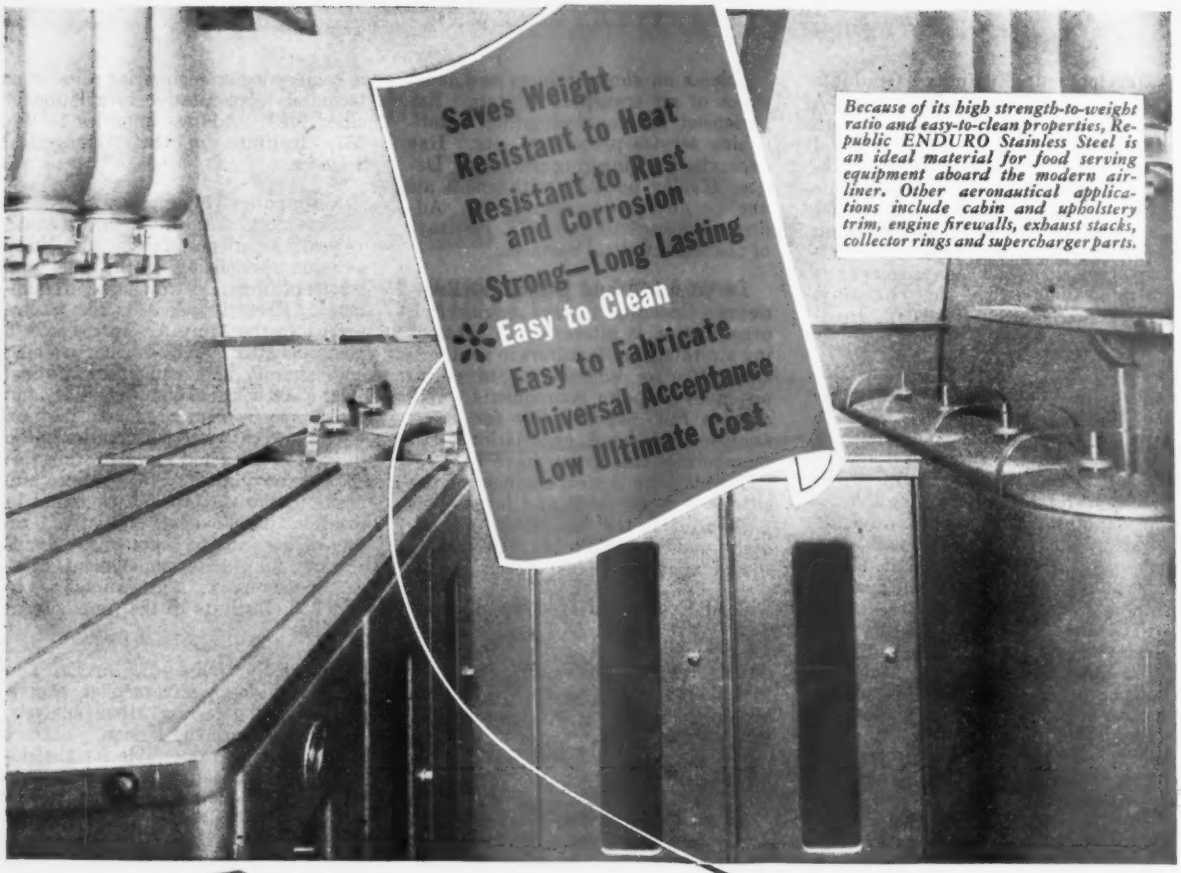
Design Specialist—B.S.Ae.E. Ten years' experience private pilot, experimental engine testing, stress analysis, preliminary airplane design, contract administration, responsible for the design and manufacture of numerous engine installations ranging from 165 to 3,000 hp., as well as turbo and turbojets. Excellent background in coordination of production and tooling acquired in capacities of project engineer and design section manager. Widely acquainted in the industry east and west. References based upon accomplishments. Desires affiliation in responsible capacity with progressive engineering organization. Address inquiries to Box 354, Institute of the Aeronautical Sciences.

Industrial Engineer—B.S.M.E. Eleven years' experience in selecting equipment and supervising installations for aircraft manufacturing processes, including experience in production of airplane motors; also twenty-five years' experience in the automotive engineering and production field. In a position to do consulting work as industrial engineer. Address inquiries to Box 353, Institute of the Aeronautical Sciences.

Engineer—B.S. in M.E. Age 27, married, two dependents. Seven years' varied aircraft engine experience. Past positions include Test Engineer, Supervisor of Carburetor Test Laboratory, and Assistant Chief Inspector. Desires engineering position doing experimental research or product development. East Coast preferred. No objection to traveling. Address inquiries to Box 350, Institute of the Aeronautical Sciences.

Development Engineer, A.E. graduate. Experience includes complete development and sales engineering of aeronautical and mechanical accessories and instruments. Background of light plane and military aircraft design. Private

(*Continued on page 103*)



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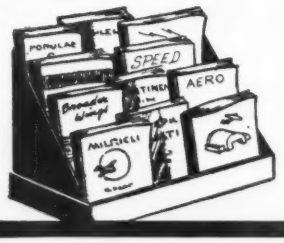

Periodicals

Accessories and Equipment

Integral Fuel Tanks for Aircraft. A. J. Savard. The writer describes how the problem of obtaining maximum fuel capacity in cargo planes is being solved by the use of integral fuel tanks. It is stated that integral fuel tanks might be defined as those spaces in an airplane, preferably the wing, in which structural components are utilized to create fueltight compartments. Reasons why the wing is preferred as a location for fuel tanks are enumerated. Information is supplied about the design of integral fuel tanks, design practices that have been found to minimize or eliminate fuel-tank leakage, and tests to determine the efficiency with which an integral fuel tank has been sealed. *Industrial Aviation*, October, 1945, pages 47–50, 83, 6 illus.

Effect of Ventilation Rate on Cabin Temperature. Myron Tribus and Avery Foote. Reference is made to the many factors on which the optimum ventilating rate in an airplane heating system depends. A description is given of a means for determining the flow rate through a given combination of heater, duct work, and airplane to result in the maximum cabin temperature. The analysis applies to heating systems of the "nonrecirculation" type, that is, systems that handle air only from the outside. *Mechanical Engineering*, October, 1945, pages 668, 669, 3 illus.

Aerodynamics

On the Stability of Two-Dimensional Parallel Flows. Part II. C. C. Lin. In the second installment of a three-part article on two-dimensional parallel flow, it is noted that the study of the stability of two-dimensional parallel flows in an inviscid fluid is usually regarded as being quite complete, through the work of Rayleigh and Tollmien. Their results show that instability depends greatly upon the occurrence of a point of inflection in the velocity profile. Because the physical interpretations of such general results do not appear to be well known, the writer gives such an interpretation. Several points in the mathematical theory which require further development and classification are also considered. Sections of the article are devoted to a survey of some of the aspects of the stability problem in an inviscid fluid; a rigorous proof of Tollmien's results for the existence of unstable modes of oscillation; the physical interpretation of instability in an inviscid fluid; and acceleration of vortexes in a nonuniform field of vorticity. *Quarterly of Applied Mathematics*, October, 1945, pages 218–234, 4 illus.

Wing Tips for Tailless Aeroplanes. A. R. Weyl. In the introduction to this article, which is one of a series dealing with tailless aircraft, it is noted that the study of the flight of birds has provided and will continue to provide valuable information for the progress of human flight. It is stated that when it comes to a struggle for the last ounce of aerodynamic efficiency, research along these lines may well become a paying proposition, especially in the case of the flying wing where the demands for stability and controllability are apt to interfere seriously with aerodynamic performance.

It is also stated that the conventional aileron is greatly to blame for the reluctance to shape the tips of a wing in a more efficient manner and that the history of the plain wing with positively raked tips (i.e., leading edge shorter than the trailing edge) provides a good example of this. Sections of the article discuss the importance of wing tip shape, uncommon tip shapes, slotted wing tips, diffuser wing tips, their characteristics and suitability. References to articles on the subject are listed. *Aircraft Engineering*, September, 1945, pages 259–266, 12 illus.

Air Cargo

Coordination of Motor Trucks and Air Transport. A large part of the October issue of *Distribution Age* is given to a study of the various aspects of "motaircargo," a term applied to the coordination of air and motor transport, with the motor trucks used to bring freight to the airplane and to take it from the airplane to its destination. The articles are as follows:

"Motaircargo Developments and Prospects." John H. Frederick. A general review is given of the development of the air-cargo business and its growth from the early use of airplanes for moving freight and express shipments. Methods of operation through cooperation with independent trucking concerns are explained and experiences in charter-cargo work are related. *Pages 36, 37, 100.*

"Motairhandling." Matthew W. Potts. Emphasis is given to the improvements that can be obtained in methods of handling air cargo at both the receiving and delivering airports. Suggestions are made for the utilization of mechanical devices for speeding the

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movement of goods from motor truck to airplane. The writer advocates the separation of passenger and cargo service, and standardization of operations, in order to eliminate delays that seriously interfere with the saving of time which is one of the cardinal factors in favor of air transportation. *Pages 38, 39, 89, 1 illus.*

"ATA Stands for Coordination." Emery F. Johnson and John V. Lawrence. Two articles are consolidated under a single title, one by the Secretary of the Air Cargo Section of the Air Traffic Conference of America, and the other by the Managing Director of American Trucking Associations, Inc., each dealing with the problems incidental to his particular field of activity. In the first article an attempt is made to answer the questions concerning coordination of air and highway transport with regard to the purpose of coordination, how it affects the two groups, and what has been done to date to advance the cause of coordination. The second article assesses the outlook for coordination from the standpoint of the motor freight carriers. *Pages 40, 41, 90, 91, 1 illus.*

"Design for Motaircargo." Martin Ullman. The writer discusses the integration of the design of motor trucks with the design of cargo airplanes, to facilitate the transport of goods from truck to plane and plane to truck. Suggestions are made for the conversion of military aircraft to commercial cargo purposes; alterations of airplane interiors, such as hinged or removable floors that could be loaded or unloaded outside the fuselage; special containers to be transferred intact between truck and plane; and improved methods of packing air shipments. *Pages 42, 43, 102, 2 illus.*

"Coordination of Air and Highway Carriers." Haviland Reves. The writer describes a plan of coordinated ground pickup and delivery used by a number of air lines in connection with regular scheduled shipments of merchandise. The design of containers suitable for "motair" and other packing problems are studied. *Pages 44, 45, 138, 4 illus.*

"International Motaircargo." George F. Bauer. The prospects for international cargo movements by air are estimated on the basis of past experience. The operations of carriers between points in the United States and Mexico are recounted, as well as the operations of the Royal Dutch Airlines, prior to the war. *Pages 56, 88, 89, 2 illus.*

"Surplus Planes and Trucks." Arnold Kruckman. The opinion is expressed that war-surplus airplanes and trucks will not seriously affect the market for new products in these categories. Figures are given with regard to the cost of converting Army air transports into commercial air liners. Mention is made of the possibility of the use of surplus government aircraft by the commercial air-transport interests. *Pages 57, 95.*

"Airplane and Motor Truck . . . Allies in Transportation." Elsa Gidlow. Successful air shipment of perishable vegetables and fruits from California to eastern ports is recounted, with information about the improvements made in the San Francisco airport to facilitate such shipments. *Pages 61, 62, 101. Distribution Age*, October, 1945.

The views and opinions expressed in this section are exclusively those of the writers or publications named. They are in no case to be construed as those of the Aeronautical Engineering Review or the Institute of the Aeronautical Sciences.

Cargo Only. Esther Forbes. The growth of air cargo, air express, and air-mail service in the United States is reviewed. Figures on the service being rendered by the different air lines are supplied. The writer describes how the introduction of all-cargo planes, and air-freight service in which air cargo is handled directly by the air lines, have aided in reducing air-cargo rates. *U. S. Air Services*, October, 1945, pages 18–20, 41, 1 illus.

Air Transport

Transports for Rent. George Herrick. The question is raised whether leasing transports for company travel and special cargo constitutes direct competition for scheduled commercial carriers. In recounting the history and operations of Page Airways, the writer tells of the problems that were encountered by this fixed-base operator when it tried to lease large transport aircraft with pilots' services, maintenance, fuel, and insurance included. *Air Transport*, October,1945, pages 51, 53, 54, 57, 58, 6 illus.

Europe Overnight. The position of and prospects for world-wide American air transport are surveyed on the basis of comparison of the commercial air operations of the future with the achievements of American air power during the war. The problems are stated to be of an economic-political nature rather than a technical nature, because the engineering problems have already been solved. Commercial aviation is shown to be a matter of national policy. The views of certain prominent air-line executives are referred to, as expressed in conferences and before Congressional committees, and a review is given of the progress that has been made to date in formulating proposed legislation to govern overseas air-transport operations. Statistics are given concerning the cost of overseas transport operations and the probable fares that can be charged, as well as estimates of the probable volume of traffic. In connection with the study, a statistical table is reproduced showing some of the specifications of the types of aircraft designed for overseas commercial service, and a chart shows existing and proposed American international air routes. *Fortune*, November, 1945, pages 117–123, 285, 286, 288, 290, 292, 294, 296, 299, 300, 305, 11 illus.

Range and Payload by Refuelling in the Air. This article is concerned with the economic aspects of refueling airplanes in flight. It discusses methods, costs, and advantages of the system by which Flight Refuelling, Ltd. (a company operating a fleet of flying tankers for refueling transport aircraft in the air) is enabled to maintain pay loads of the transport airplanes at a maximum on long-distance flights. Included in the article are specifications and drawings of an air liner, Flight Refuelling Type F.R. 11, which would make use of flight refueling in order to obtain the range for flying the Atlantic Ocean. *The Aeroplane*, September 28, 1945, pages 362–364, 2 illus.; "Refuelling in Flight," by C. H. Latimer Needham, *Flight*, October 4, 1945, pages 372–375, 6 illus.

It's in the Cards. D. H. Gray. The functions, setup, and operating procedures of Trans-Canada Air Lines' Aircraft Statistical Bureau are outlined. The system is so designed that all posting, filing, and signal movements may be performed by nontechnical clerical personnel. Pertinent data are extracted by tab signals on record cards on a semiautomatic basis. Although the bureau is reported to be responsible for all statistical reports relating to flight-crew times, aircraft performance, miles and hours flown, delays and irregularities, as well as for records pertaining to the location, condition, and history of all aircraft components, the procedures reviewed in this article cover only those phases that were developed primarily for the use of the engineering and maintenance departments generally and the inspection department in particular. Some of the cards and forms employed are illustrated. *Air Transport*, October, 1945, pages 31–35, 6 illus.

Plane Sense and Bush Flying. Part IV. Dale S. Atkinson. An analysis of the potentialities, costs, rates, and revenues of air-transport operation in northwestern Canada is continued in this fourth article of a series. The writer explains how various charts can be built from a previously described "load distribution" chart giving the relation between pay load and distance for an aircraft. Through the use of the chart system, further comparisons of the efficiencies of three types of aircraft employed in "bush" flying are made. *Canadian Aviation*, October, 1945, pages 85, 86, 130, 4 illus.

Integration. C. Edward Leasure. The first of a series of articles discussing the integration of all forms of transport in the United States and the coordination of their operations. In this introduction to the subject the writer develops the background of administrative regulation by which the

CABIN TEMPERATURE CONTROL—
A new electronic system, which controls cabin temperatures with extreme accuracy, has been applied to both steam and combustion type aircraft heaters. Three temperature sensitive elements in the system keep the cabin air at the selected temperature by maintaining the heat supply equal to heat losses. Overshooting is prevented by accurate control of heater discharge temperature.

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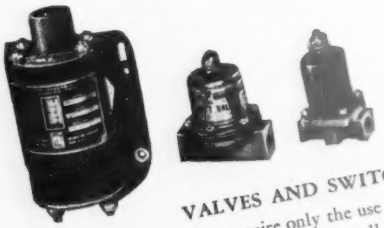

VALVES AND SWITCHES—
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CONTROL SYSTEMS

independence of air transport has been fostered. *National Aeronautics*, October, 1945, pages 21, 22, 59.

Ship 24. T. V. Bihler and Fowler Barker. Flight operations of one of the DC-3 airplanes of Northeast Airlines, Inc., are analyzed, with particular reference to the performance of the plane on a winter day, February 4, 1945, and on a summer day, August 5, 1945. The conditions prevailing along that air line are stated to be unusual because of the relatively short flights between the communities served, involving frequent take-offs and landings. Despite the handicap of frequent stops, a system has been devised for reducing to a minimum the time consumed in stops, and details are given about the means adopted for minimizing such delays. Charts show how closely the actual operations conformed to the schedules in effect on the days recorded. The flight logs are reproduced and information is given about the crew members, their qualifications, rates of pay, and other data. *Air Transport*, October, 1945, pages 20–26, 8 illus.

Airplane Descriptions

Blackburn Firebrand IV. The first of two articles appraising the design, construction, and performance characteristics of the Blackburn Firebrand IV, deals with the background and development of this British naval fighter and torpedo airplane. Citing the Firebrand IV as a single-seater fighter of excellent performance and great striking power, it explains why the plane was modified to accommodate a Centaurus radial engine instead of the Sabre engine which was originally used. Primary changes in the course of development from the Firebrand I to the Firebrand IV are outlined.

Part I also surveys some of the main features of the latest Firebrand model including its layout, fuselage, tail unit, and center section. Tables of data, photographs, and schematic drawings supplement the description.

The concluding half of the two-part appraisal of the Blackburn Firebrand IV contains particulars about the wing center section and wing-folding arrangement; the layout of ailerons, flaps, and dive-brakes; and the armament installation. It also notes features of the cockpit and controls. *Flight*, September 27, 1945, pages 338–341, 6 illus.; October 4, 1945, pages 367–369, 9 illus.; "A Naval Strike Fighter," *The Aeroplane*, September 28, 1945, pages 357–361, 10 illus.; "The Blackburn Firebrand, Carrier-Borne Aircraft," *Engineering*, October 5, 1945, page 266, 2 illus.

The Stinson Voyager 150. Leighton Collins. An account is given of the flight characteristics and performance of the 150-hp. four-place Stinson plane. The Voyager 150 is credited with being a "good-climbing, quiet, moderately fast, quick-stopping, easy-to-fly" aircraft. *Air Facts*, November, 1945, pages 68–85, 1 illus.

The Blackburn Firebrand IV carrier-borne aircraft.

Vickers Viking. C. B. Bailey-Watson. Some further information is supplied about the Vickers Viking, showing that early estimates of this transport aircraft's performance have been exceeded. Aerodynamic efficiency, performance characteristics, and operating costs of the plane are analyzed. The commercial utility of the flexibly mounted wings is stressed. Four tables list the Viking's assumed approximate operating costs, loadings, performance figures, and weight percentages. *Flight*, October 4, 1945, pages 364–366, 2 illus.

The Airspeed Ambassador. Accompanied by an illustration of the aircraft, details are given about the Airspeed Ambassador, designed for short-haul transport service. A high-wing all-metal monoplane with tricycle undercarriage, the Ambassador is powered by two interchangeable Bristol Centaurus 2,500-hp. engines. It will carry 36 passengers over intermediate distances from about 200 to 800 miles, and with 25 passengers will operate over distances up to 1,300 miles. Maximum loaded weight is 45,000 lbs.; maximum cruising speed is estimated at 300 m.p.h.; and maximum range speed is placed at 210 m.p.h. *The Aeroplane*, September 21, 1945, page 326, 1 illus.

Airports and Airfields

Airport Revenues. Part I. J. Kirk Baldwin. Part I of a continued article on airport operation discusses the aircraft-service operator. Figures are quoted for the anticipated number of certified civil aircraft that will be operating in the United States during the next 10 years. It is stated that the future for civil aircraft-service operators is bright. Emphasis is placed on the importance of putting the airport on a self-sustaining basis. The writer explains why he believes airport service operators and private fliers should pay their fair share of the expenses. *Airports*, October, 1945, pages 46, 47, 1 illus.

Building the Small Airport. Part VIIB. Marc Thompson. Installment VIIB of an article on small-airport construction is concerned with the design, construction, location, and equipment of maintenance and storage hangars. Details are discussed under topical headings of maintenance hangars, plane space, shops and services, materials, type of hangars, personal-plane storage, size of unit, size of hangar, and spacing of hangars. Four sketches illustrating the text show a typical unit of four bays, a square hangar of four units, a rectangular hangar of six units, and the spacing of the six-unit rectangular hangar. Other sketches suggest a possible arrangement of continuous units having a high number of units per acre, spacing of the four-unit square hangar, and a possible arrangement of the square hangar in a continuous building. *Aviation Maintenance*, October, 1945, pages 48–51, 118, 120, 122, 124, 11 illus.

Taxiway Facilities for Better Ground Handling. John H. Frederick. The writer points out common imperfections in the design and layout of taxiways which are the result of airport planning without consideration of the possible use to which the facilities may be put.

It is urged that airport managers study individual conditions in order to bring

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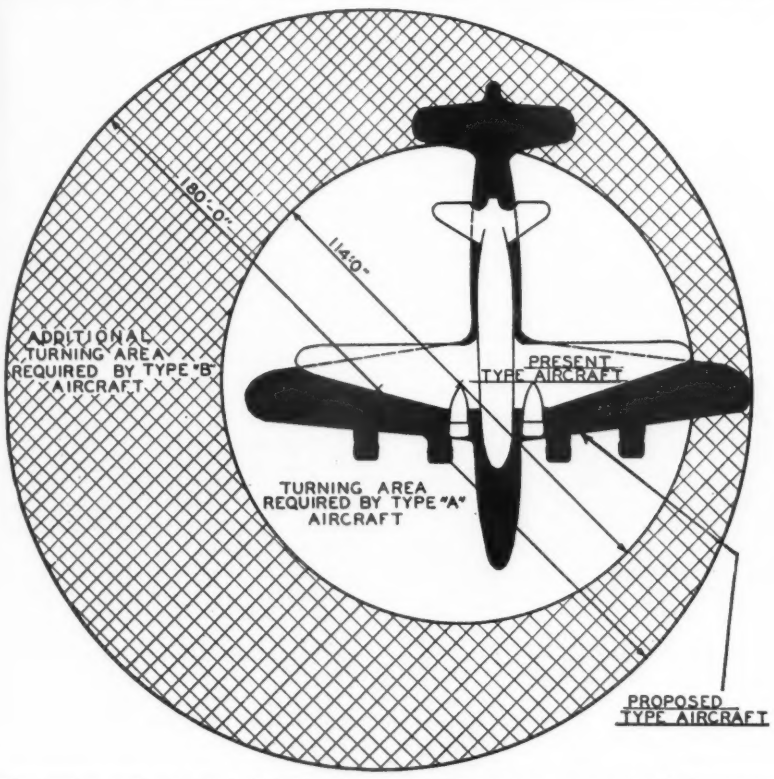


The turning radii of a typical air liner of the 30-passenger type compared with the turning radius of one of the proposed air liners of the 200-passenger class (solid outline).

about improved taxiway facilities. *Southern Flight*, October, 1945, page 64, 3 illus.

Conquest in Snow. Methods of keeping airport runways usable during the winter are described. It is emphasized that where possible complete snow removal is desirable. Information is given about maintaining runways for both ski- and wheel-equipped aircraft by the method of combined compaction and removal of snow. The equipment required is described. Diagrams show the method of preparing a runway by plowing and scarifying for snow removal by a blower, and the way to mark a snow-covered runway with evergreens. *Canadian Aviation*, October, 1945, pages 54, 55, 106, 10 illus.

Matching the Two Airport Bills. J. G. Sourwine. The writer analyzes the Lea and the McCarran airport bills. He describes what each bill calls for and explains wherein they differ and agree. *Airports*, October, 1945, pages 28, 30, 32.

Tips on Winterization of Airport Field Lights. Methods are outlined for maintaining airport field lights and obtaining the most efficient use from them under snow conditions. Procedure suggestions and equipment recommendations are made by three C.A.A. airport-lighting engineers, the President of the Revere Electric Manufacturing Company, and the President of the Aerolite Corporation. *Aviation Maintenance*, October, 1945, pages 46, 47, 98, 100, 8 illus.

Deep in the Heart of Pittsburgh. George R. Reiss. The financially successful operation of a flying school located in the heart of a large city is described. The writer tells how one operator has made use of a fleet of Piper Cub seaplanes operated from the riverfront of downtown Pittsburgh to build up a flying service that within 4½ years is stated to have grossed $80,000 a year. The success of this venture is attributed to bringing the flying service to the customer. *Air Trails*, November, 1945, pages 30, 31, 92, 4 illus.

"Lily," The Floating Airstrip. This article deals with an experimental floating air strip sponsored by the Royal Navy. Based upon the principle of artificially increasing the surface tension of water, the "Lily" floating air strip is reported to consist of numbers of buoyancy cans with hexagonal surfaces, so linked together that they "give" in a controlled manner to the motion of the sea from any direction, while remaining sufficiently rigid to bear the weight of a heavy aircraft. Differences between the "Lily" air strip and the "Swiss roll," a floating pier developed by the same inventor, are indicated. *Flight*, September 27, 1945, page 330, 1 illus.

Hangar Selection and Space Utilization. Lee J. Bregenzer. Some pointers are offered to aircraft service and feeder air-line operators on the types of hangars that should be most suitable for their purposes and the factors to be considered in selecting the hangars. Advice is also given on how to utilize most efficiently available hangar space. The recommendations pertain to the buying, renting, and building of hangars. The desirability of having separate hangars for each operation (overhaul and repair, storage, etc.) is stressed. *Aviation Maintenance*, October, 1945, pages 42–45, 2 illus.

Curing the Airport Bottleneck. Glen A. Gilbert. Conditions that delay the movement of aircraft at airports are described. Factors to be considered in improving the flow of air traffic to and from airports are discussed in sections dealing with airport design, airport spacing, traffic control, approach control, the V.H.F. system, and the use of radar. *Airports*, October, 1945, pages 18–20, 6 illus.

Community Provisions for Airport Development. Leigh C. Fisher. The first of a series of articles on the development of community airports. The National Airport Plan, which would provide Federal aid for the development of airports, is discussed. The need for a thorough local plan is emphasized.

The steps necessary to arrive at a profitable and efficient airport operation are outlined. *Southern Flight*, October, 1945, pages 62, 63.

How the Army Maintained Airfields. Col. M. J. Goodman. How the equipment used by the Army Air Forces to maintain airfields may be adapted to civilian use is related. Information is given about the various types of equipment used by the A.A.F. and the way each was employed in airport maintenance. *Airports*, October, 1945, pages 22, 23, 5 illus.

Armament

A Historical Footnote on Rocket Drive. G. R. Satchler. Early rocket drive developments are briefly reviewed. The writer outlines Chinese, French, Russian, German, British, and American developments in this field. The article has particular reference to rocket weapons. *Aeronautics*, October, 1945, page 75.

Self-Contained Subassemblies Feature B-29 Four-Gun Turret. Part II. P. E. Humphrey. The concluding section of a two-part article about the General Electric gun turret is concerned with the electropneumatic gun charger. The three major components of that unit are described and the operation is explained. This is followed by descriptions of the automatic compressed-air system for the charger and its operation, the control and power-circuit collector assembly, and the fire-interrupter unit. Details are given about the method of installation of the complete turret in the airplane. *Aviation*, October, 1945, pages 152, 153, 6 illus.

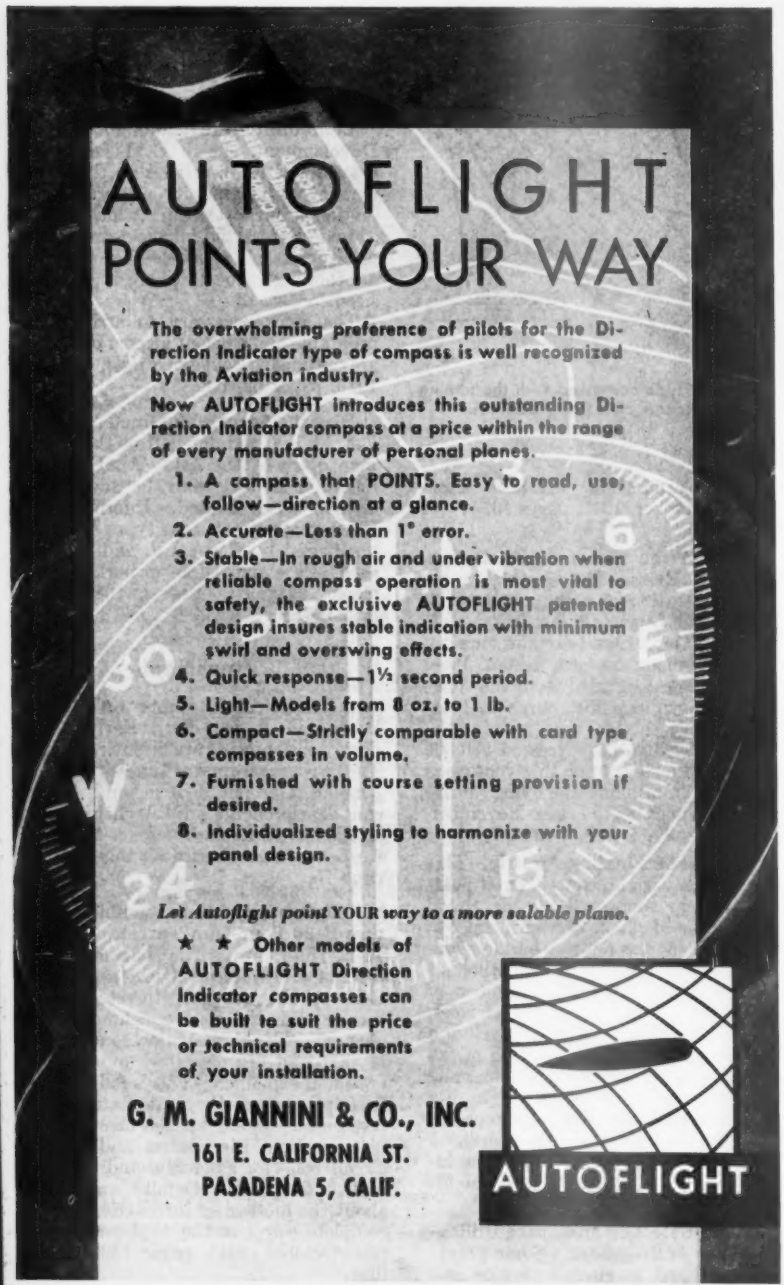
Avigation

It's the Map that Counts. John R. Hoyt. The importance of the art of map reading to airplane pilots is emphasized. Information regarding the technique of map reading is supplied. *Flying*, November, 1945, pages 30–32, 70, 72, 74, 5 illus.

The Decca Navigator. An explanation of the principles, operation, and advantages of a new radio system for instantaneous and accurate position indication. The basis of position determination by means of the Decca Navigator depends upon the relation of the readings of two dials to a special chart. The equipment is completely self-contained and its weight in the aircraft is 27 lbs. It is claimed that anyone can learn to use the device within 5 min. *Flight*, September 13, 1945, pages 285, 286, 1 illus.

Finding the Navigational Stars. Part X. Ben C. Kenny. The tenth installment of a continued article about the navigational stars gives further information about the observation of the celestial sphere from a point on the surface of the earth. Those stars that appear to be describing concentric circles about the elevated celestial pole and do not seem to set as the other stars do are called the circumpolar stars. Emphasis is placed upon that part of the sky which lies near the north celestial pole. That portion is visible from the United States at all times of the year, and by referring to the stars located therein the observer can locate the navigating stars farther south during any season. The change that has taken place in the 6 months between April and October, as a result of the completion by the earth of a half revolution about the sun, is noted. It is stated that the circumpolar region will appear to be inverted as compared with its aspect at the same hour on a night 6 months' earlier. The positions of the navigating stars Dubhe, Polaris, and Kochab, and the "additional" star Alkaid are restated, these being located in the vicinity of the Large Dipper. On the opposite side of the pole is found the constellation Cassiopeia, which contains two navigating stars, Caph and Ruchbah. Schedir is a third member of the constellation that can be used as a navigating star although it is not actually so listed. Not far from Cassiopeia is the navigating star Marfak in the constellation Perseus. This star can be located with reference to others in the diagram accompanying the article, but a more definite method for identifying it is reserved for a future installment in which the whole constellation Perseus is to be discussed.

The ninth and last of the circumpolar navigating stars is Etamin in the constellation Draco. The form of the constellation is described as an aid to the identification of the star. The current installment concludes with remarks about the circumpolar stars as a key to the seasonal stars because of their year-round availability. The article is illustrated by a night photograph of the region of the sky lying within 42° of the north celestial pole, showing the circumpolar stars, and a diagram of the important stars of that group. *Aero Digest*, October 15, 1945, pages 64, 65, 2 illus.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Business and Finance

Don't Sell This Industry Short. Raymond L. Hoadley. The outlook for investments in aircraft securities is surveyed from the standpoint of the future prospects of the industry following the termination of the war-production program. Progress made by various companies toward reconversion to civilian business is reviewed, together with figures concerning the amount of business remaining on the books of the companies, the expenditures involved in reconversion, and estimates of future business volume. It is stated that preliminary estimates show the industry entering its reconversion phase with a probable backlog of $1,500,000,000, which compares with a prewar volume of only $200,000,000. Noting that most of the companies outside of the aeronautical industry which were engaged in aircraft production do not intend to remain in that business, figures are given to show the total plant investments of the permanent members of the aircraft industry. Attention is directed to the improvement in financial position

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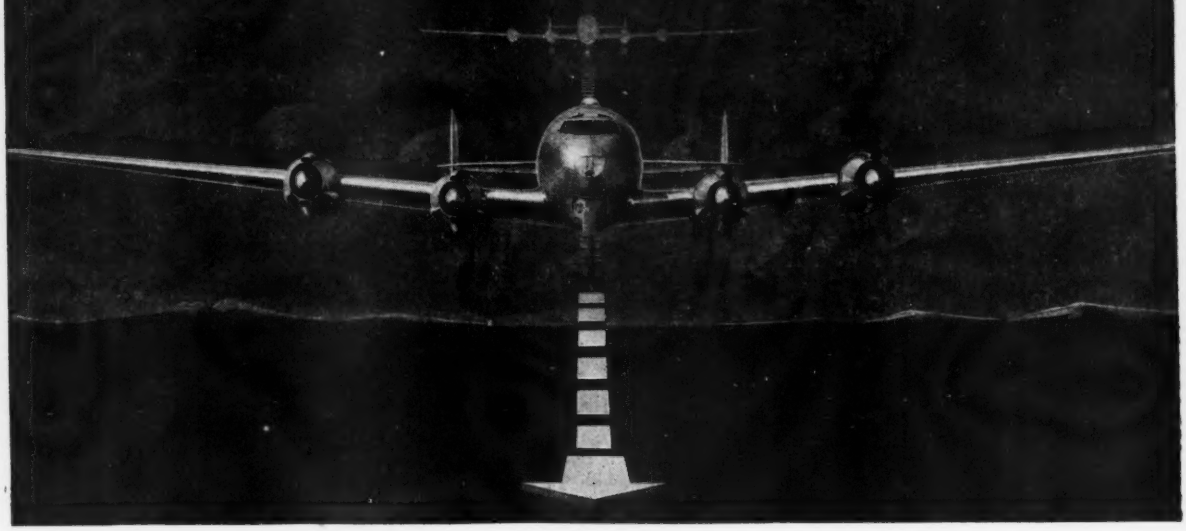

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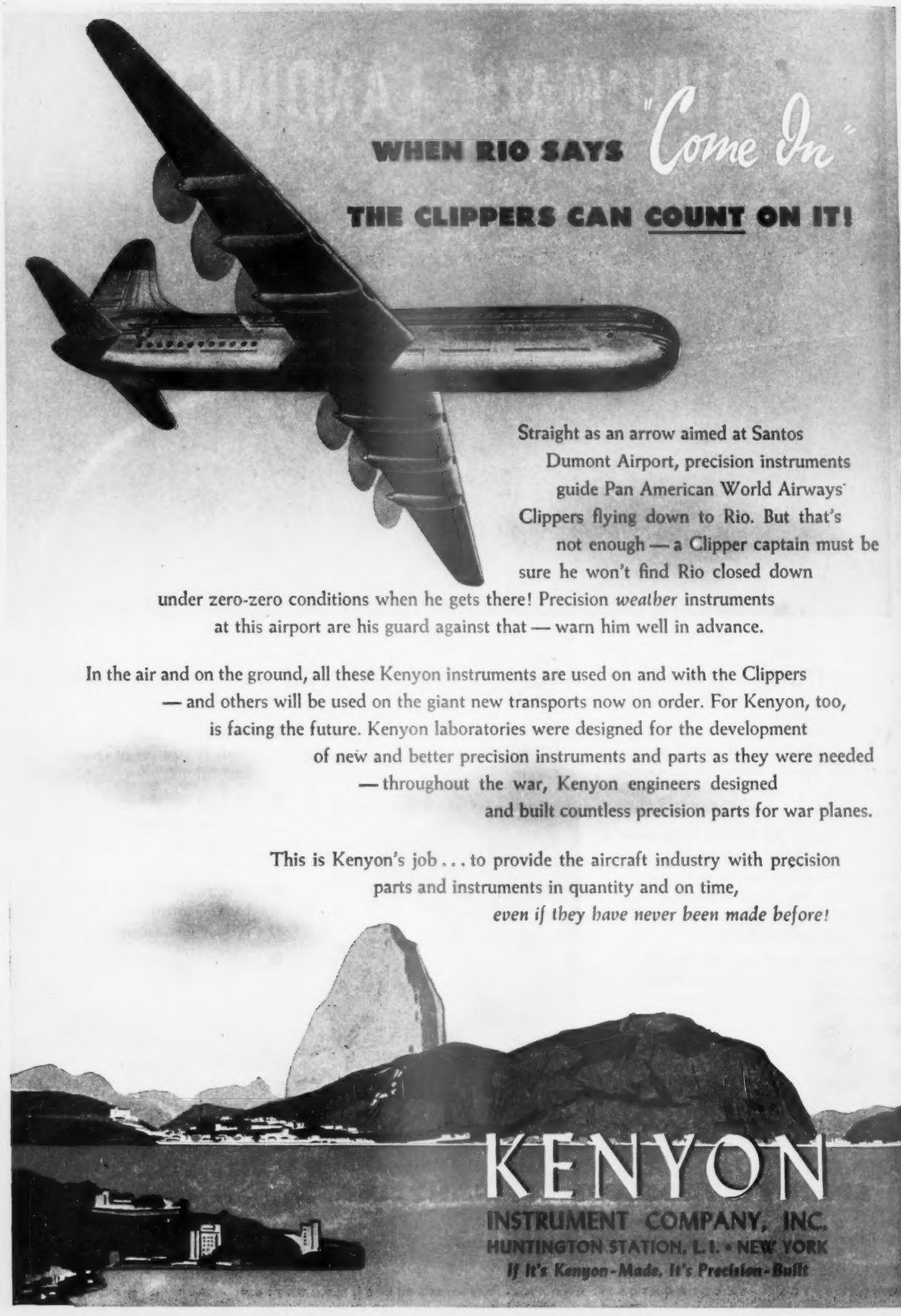
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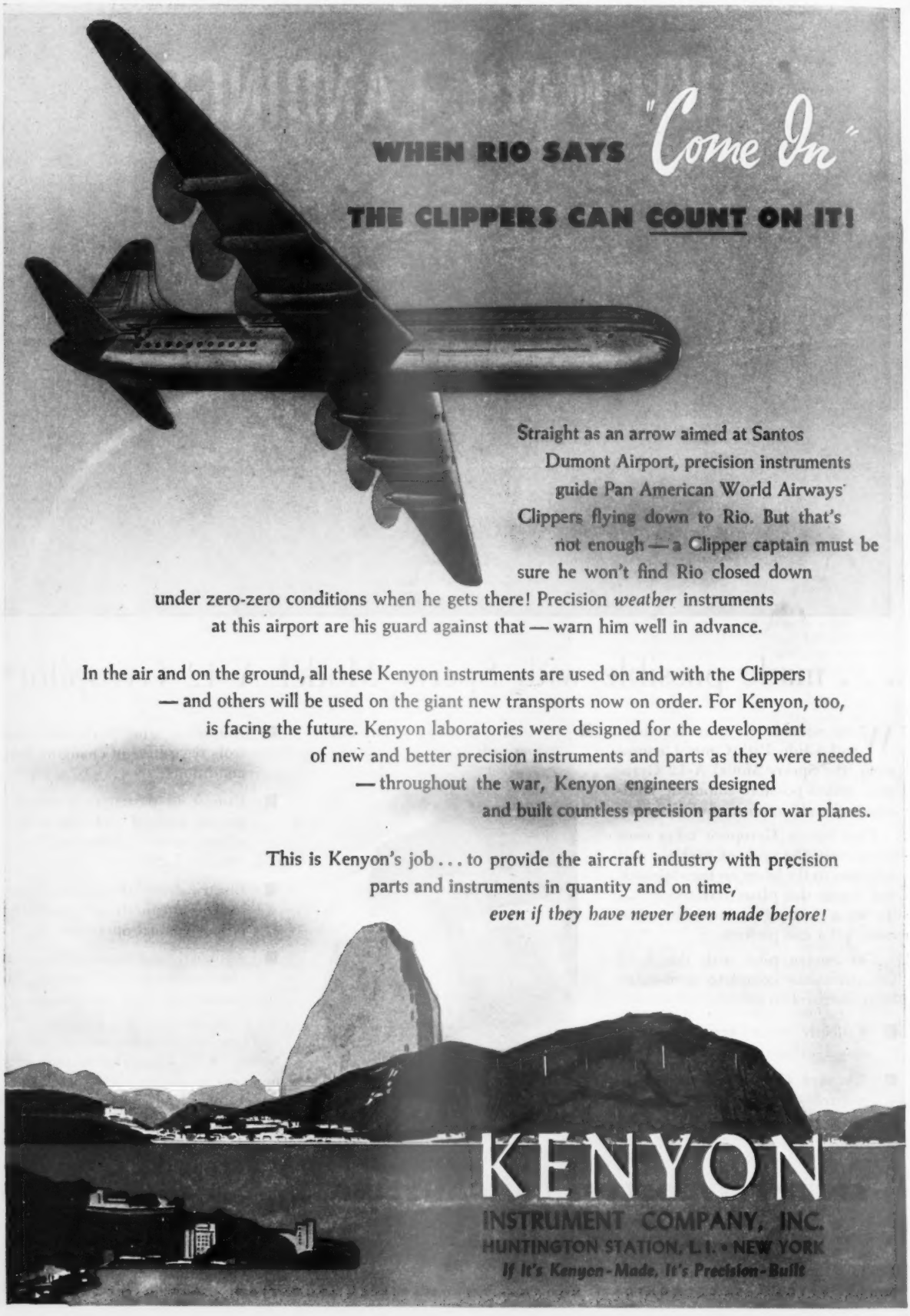
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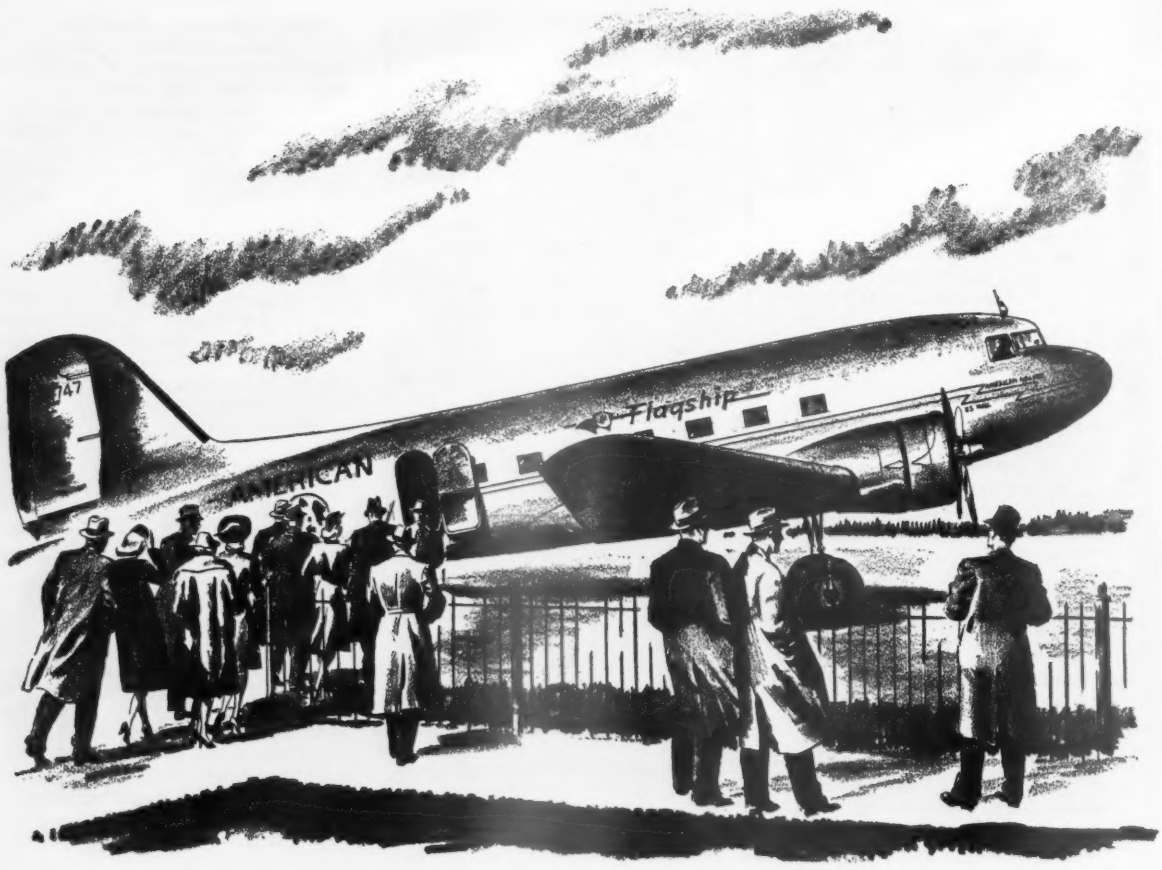

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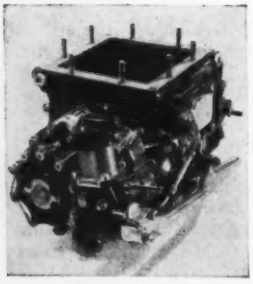

American Airlines' records show that the Holley Carburetor serial #78 pictured in the inset at left, has given 19,400 hours of dependable, trouble-free service. It has flown some 3,104,000 miles and is still in service. In these hundreds of trips this carburetor metered approximately 875,000 gallons of high octane gasoline to the engine it served. Almost half a century of research and scientific manufacture has built stamina and dependability into every Holley Carburetor. That's why commercial airlines look to Holley for carburetor leadership and dependability of performance!

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executive as a result of the speed and ease of making business trips by air are contrasted with the costs of this type of travel. One of the most important factors noted is the need for more and better landing areas to facilitate business travel by airplane and suggestions are made for the improvement of existing airports and the building of new facilities. It is concluded that expenditures of public funds for the extension of landing facilities for private aircraft will be fully justified by the increased benefits arising from the expansion of business travel by air. *Aero Digest*, October 15, 1945, pages 62, 63, 113, 2 illus.; "He Gave Wings to the Steel Business," by Edward E. Thorp, *Aviation*, October, 1945, pages 164, 165, 4 illus.

Companies

Iceland Airways. The operations of Iceland Airways, Ltd., are described. The information includes details about the company's formation, reorganization, equipment, routes, diversity of operations, climatic and geographic operational conditions, volume of passenger traffic, progress in terms of flying hours, and future prospects. *Flight*, September 13, 1945, pages 292, 293, 2 illus.

United Corporate Portrait. James Gowdy. The history of United Air Lines is traced, with figures showing the company's growth. Brief biographic sketches are supplied of some of the executives, including William A. Patterson, J. A. Herlihy, Harold Crary, John W. Newey, C. C. Thompson, Hal E. Nourse, Paul G. Hoffman, Eric Johnston, Justin Whitlock Dart, and Gardner Cowles, Jr. *Air News*, November, 1945, pages 89, 94, 95, 6 illus.

Deicing

Correct Servicing Determines De-Icer Efficiency. Part I. Suggestions are made for the proper steps to be taken in the maintenance of deicing equipment, particularly timely in view of the longer flights now being undertaken by commercial aircraft. The usual types of deicing equipment are described and routines are recommended for the inspection and repair of the various components of the deicing system. The organization and operation of a deicer-repair room are suggested, with a view toward maintaining the best possible efficiency and operating conditions. Detailed instructions are given for making repairs to the pulsating-tube type of deicing equipment. *Aviation*, October, 1945, pages 157–160, 20 illus.; "A Graphical Solution of Windshield Heat De-Icing Problems," by Harry H. Hanger; *Industrial Aviation*, October, 1945, pages 28, 30–32, 34, 78–81, 5 illus.

Design

Designing Tomorrow's Personal Plane. Part V. Ralph Upson. The so-called roadable airplane is investigated in the fifth section of a serial article. It is suggested that three alternatives in approaching the design of such a device would be (1) to modify existing automobile design to permit flying; (2) to modify an existing airplane to make it roadable; (3) to create an entirely fresh design by exploratory research. Primary and secondary weight considerations are shown to govern the first and second alternatives. In addition to weight, the design of wheels equipped to transmit power for road use is one of the problems affecting the second alternative. A hydraulic transmission would solve the questions of driving power for the road. Estimated weights and cost items are tabulated.

With regard to the third alternative, it is suggested that the airplane might be equipped with folding or detachable wings and propelled by its own airscrew for short trips on the highway. Weight, lift, and drag estimates are given. The advantages of the controllable wing are explored and it is concluded that, as in many other matters of design, the solution will ultimately be found in compromise. *Aviation*, October, 1945, pages 142–147.

The Geometry of a Structural Joint. C. F. Allen. An article written to assist students in making preliminary layouts of a structural joint with compound angles. It is stated that in a proposition of this sort a certain confusion of thought arises when the true angles between various members meeting at the joint are required, involving a considerable amount of layout work which when completed is not always easy to check. The method described shows one way of attacking the problem where, by the use of a few sketches, the required true angles and other dimensions can be found without resorting to layouts. *Aircraft Engineering*, September, 1945, pages 257, 258, 4 illus.

Design Details of the Boeing B-29. Part II. Continuing an engineering analysis of the Boeing B-29, this second installment details the design and construction of the wing sections, flaps, ailerons, stabilizers, and elevators, and their actuating mechanisms. Particulars are also given about the landing-gear components, the gear-retracting mechanisms, the electrical system, the auxiliary power unit, and the fuel system. Sectional drawings of the various parts illustrate the text. *Aero Digest*, October 1, 1945, pages 51–55, 8 illus.

From Cockpit to Cabin. Peter M. Bowers. It is stated that the canopy is one feature of the modern airplane which has evolved as a result of improved performance rather than as a product of research in the streamlining field, and that only recently has it become an important part of the streamlining of a high-speed airplane. The history of the development of the canopy is reviewed. The various types of canopies provided on aircraft of the past and present are described. *Air News*, November, 1945, pages 67, 96.

Design Analysis of Messerschmitt Me-262 Jet Fighter. Part I. John Foster, Jr. The first part of a comprehensive design analysis of the Messerschmitt Me 262 describes the design and construction of the air frame and its components. Much of the information is based on data made available through the facilities of the Foreign Equipment Branch of the Technical Data Laboratory of the Air Technical Service Command. In addition to a detailed description of the different parts of the air frame, the methods of construction are explained at length and a considerable amount of information is given about the armament and instrument equipment. The explanations are supplemented by photographs and drawings showing many of the construction details.

The second part of the analysis, to appear in a future issue, will take up the Junkers Jumo 004 gas-turbine jet-propulsion power plants used in the Me 262 and other aircraft. *Aviation*, October, 1945, pages 115–135, 49 illus.

Converting C-47's in Australia. Illustrated by a general arrangement drawing, specifications are given for the conversion of Douglas C-47 and C-47A aircraft to the required forms for civil air-line operations in Australia. Modifications include rework of the fuselage structure for installation of the cabin door, baggage-compartment door, and one of the bulkheads; addition of windows, seats, buffet, and laboratory facilities, ash trays, reading lights, etc.; alterations in heating and ventilating systems; cabin soundproofing; modification of the electrical system; and installation of different radio equipment. *Aero Digest*, October 1, 1945, pages 73, 92, 1 illus.

The Influence of Wartime Experience on Aircraft Design. Earl T. Klein. How experience gained during the war in the production of aircraft will aid in the development of future aircraft is discussed. Reference is made to a research and development program of the Curtiss-Wright Corporation, which is based on a thorough understanding of the many problems that must be faced and successfully overcome by commercial operators. It is stated that low-cost operation is the objective toward which the coordinated efforts of all the projects are pointed. The use of plastics and the strides made in plastic technique during recent years are emphasized. *Western Flying*, October, 1945, pages 48, 49, 126, 6 illus.

A Graphical Solution of Windshield Heat De-Icing Problems. Harry H. Hauger. The problem of designing an air-heated double-paneled windshield for aircraft is investigated. A windshield ice-prevention nomograph is proposed as a rapid, accurate method of making a design analysis of the air-

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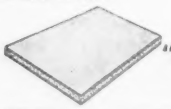
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heated windshield. With its use the designer has at his disposal a visual means of determining the relative importance of the variables included within the design, so as to arrive at the optimum solution for a given installation under the conditions imposed. The sample problems analyzed in this article indicate that the required windshield strength be designed into the inner panel, with an outer panel of tempered glass, so as to obtain the highest outer-surface temperatures. It is stated that the design method can be used for any airplane speed and altitude provided the outside heat-transfer coefficient can be calculated. *Transactions of the A.S.M.E.*, October, 1945, pages 513–521, 3 illus.; *Industrial Aviation*, October, 1945, pages 28, 30–32, 34, 78–81, 5 illus.

Landing Analyses for Flying Boats and Seaplanes. Part I. Ernest G. Stout. Design aspects for flying boats are set forth in an analysis of the factors that must be provided to take care of rough-water landings of such aircraft. The landing phenomena are resolved into three fundamental considerations: (1) rough-water analysis; (2) impact integration; and (3) skipping analysis.

The first item is defined as a technique for landing seaplanes or ditching landplanes in rough seas, and the analytic treatment of those complex operations. The second factor is a mathematical analysis developed by the writer to assist the designer in isolating various design parameters and in gaging their isolated effect on landing impact. The third is called a most important and sometimes disastrous form of dynamic instability encountered frequently during landings in otherwise satisfactory flying boats or seaplanes.

It is noted that the second and third items are primarily smooth-water functions, readily lending themselves to analytic treatment whereas rough-water analysis is complex because of the difficulty of accumulating an adequate background of accurate full-scale information. The analysis offered in the article is intended to overcome these disadvantages to a great extent by providing an analytic system that does not involve the risk of damage to the equipment through the hazards of flight testing. The rough-water analysis is developed with the necessary mathematical formulas. *Aviation*, October, 1945, pages 137–141, 4 illus.

Electrical Equipment

Electrics for Aircraft. C. G. A. Woodford. In the introduction to this extensive paper the writer states that recent discussions indicate the time is ripe for British aviation to benefit from a wider use of electrical equipment. He points out that there has been a lack of appreciation of what such benefits could be and of the special needs of aircraft in regard to the right type of electrical equipment. The hope is expressed that the paper will assist in crystallizing the views of the aircraft designer as to

How Monel was used to solve a DIFFICULT FABRICATING JOB

Oil coolers for Superfortresses called for a strong, corrosion-resistant metal that could be worked, resistance-welded and soft-soldered dependably.

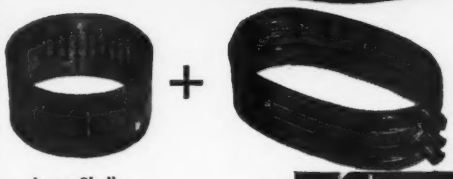
All-Monel shell for oil cooler. Made by Whitehead Heater Co., Vernon, Cal. Complete assembly by AiResearch Manufacturing Co., Los Angeles, Cal.

(Photos released through U. S. Army)

Inner Shell

1. WELDING IN ANGLES

After the inner shell has been formed from Monel sheet by punching and welding, Monel angles are spot welded on the inner surface to form channels for the baffles. Monel baffles, which also act as supporting struts, are spot welded in later.



Inner Shell + *Outer Shell*

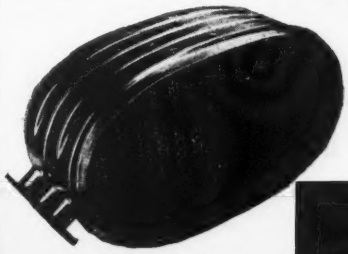
2. WELDING SHELLS TOGETHER

The outer shell is also formed from Monel sheet by punching, pressing and welding. Then, inner and outer shells are welded together. Vital dimensions are to very close tolerances.

Completed Shell

3. ATTACHING THE FLANGE

With baffles already in, the all-Monel shell is completed by silver-brazing on the Monel flange. Flange must be flat within 0.005". Baffles must be parallel and correctly spaced within ± 1/64".



Completed Cooler, with copper tubes soft-soldered in place

4. INTO A B-29 ENGINE

Using a jig, the finished cooler is installed in an engine of a Boeing Superfortress. The 92.5 lb. unit contains 32 lbs. of Monel, 50.5 lbs. of copper, 10 lbs. of soft solder. Monel is galvanically compatible with copper.

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C26—Unshielded

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what he might advantageously use and so help to indicate what should be made available for the next and following phases of aircraft development.

Sections of the paper discuss the applications of electrical services and the object of electrifying services; power supply; actuation services; electronic devices; lighting; and installations. Following this review of the possibilities of lightweight a.c. equipment and the principles underlying its use, the writer provides an outline of a recommended system for an aircraft of medium size. Abstracts are given of discussions of the paper and of written replies by the writer to points raised in the discussions. *The Journal of The Royal Aeronautical Society*, September, 1945, pages 518–565, 8 illus.

Automatic Temperature Control for Aircraft. R. A. Gund. Because the automatic control of engine-head temperature, oil or coolant temperature, and carburetor air temperature requires the same fundamental equipment, the greater part of this paper is confined to engine-head control as a representative system. A description is given of the various types of systems and the limitations and advantages offered by each. The operating characteristics of the on-off, point-modulating, band-modulating, and sensitized modulating systems are analyzed. The advantages of the sensitized band-modulating system are described. *Electrical Engineering*, October, 1945, pages 730–734 (Transactions), 20 illus.

Design Problems for Safe Failure in Aircraft Electrical Systems. Col. T. B. Holliday. Consideration is given to the designing of aircraft electrical equipment so that a failure of any device will not affect other devices and result in a complete breakdown. An analysis is made of problems inherent in obtaining "safe" failure in the generation, distribution, and power-utilization systems. *Product Engineering*, October, 1945, pages 657–659, 4 illus.

Engines

Primary Factors in Choosing Aircraft Engine Materials. Colin Carmichael. In this article a comparison is made of the materials used by five of the leading aircraft engine manufacturers for 18 critical parts, and the reasons for their selection and the processes used in their fabrication are discussed. The engines include the Allison V-1710, Continental A and C Series, Jacobs L-4 (R-755), Kinner R-56, and Lycoming 4, 6, and 8.

Tables give the normal composition of aluminum-alloy parts, steel structural parts, and valve-mechanism parts. *Machine Design*, October, 1945, pages 111–114, 1 illus.

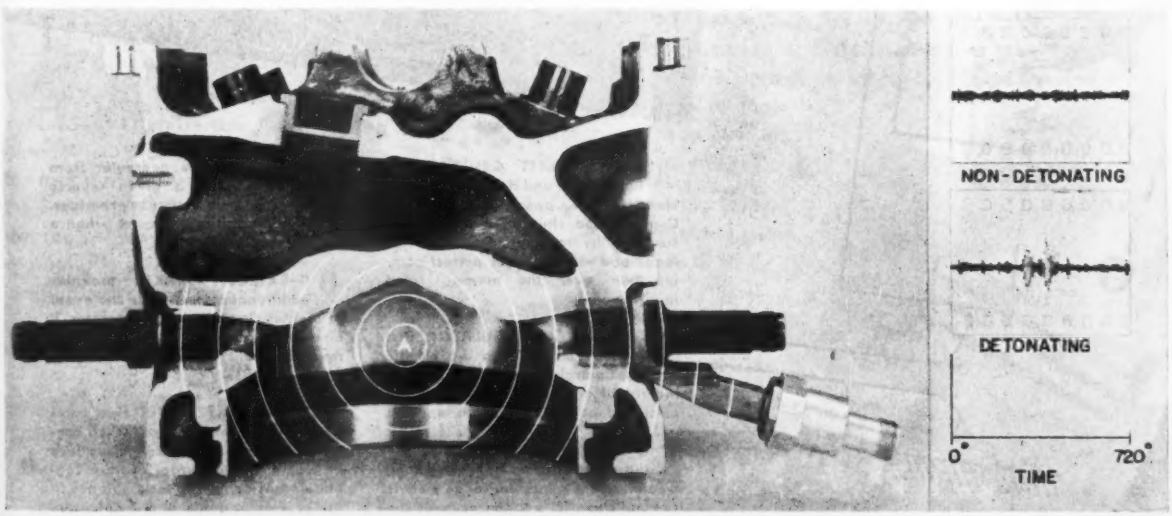
Development of the Allison 3420. R. M. Hazen. With the design and features of successive models noted, the evolution of the Allison V-3420 series of aircraft engines is traced from the original of 1936 to the latest version. Installations reviewed include those in the Douglas XB-19A, XB-39 (Allison-powered B-29), and P-75.

The V-3420 is described as a 24-cylinder in-line engine. The cylinders are arranged as a double Vee, each Vee having 12 cylinders. The various models include the V-3420-A series, which has both crankshafts rotating in the same direction (either clockwise or counterclockwise) and the "B" which has the two crankshafts rotating in opposite directions to each other. More than 90 per cent of the parts of the V-3420 are components identical with those of the Allison V-1710, and the V-3420 is said to be essentially two 1710's with a common crankcase. *Aero Digest*, October 1, 1945, pages 75, 76, 79, 106, 8 illus.

Detonation Indicating Equipment for Allison Engines. John M. Whitmore and John R. Burns. Because commercial equipment for detonation research was not considered adequate when the Allison Division of General Motors Corporation began work on detonation in 1941, a program was initiated to develop necessary equipment. This paper describes the development and use of instrumentation for the detection of detonation in the Allison liquid-cooled aircraft engine. Particulars are given about equipment that has proved to be successful in determining detonation limits, in acting as a danger signal, and in detecting certain installation troubles. As a routine flight instrument it permits maximum power to be developed with minimum hazard, and under certain conditions permits maximum safe cruising economy. It may also be connected to servomechanisms for automatic control. *SAE Journal*, October, 1945, pages 595–602 (Transactions), 12 illus.

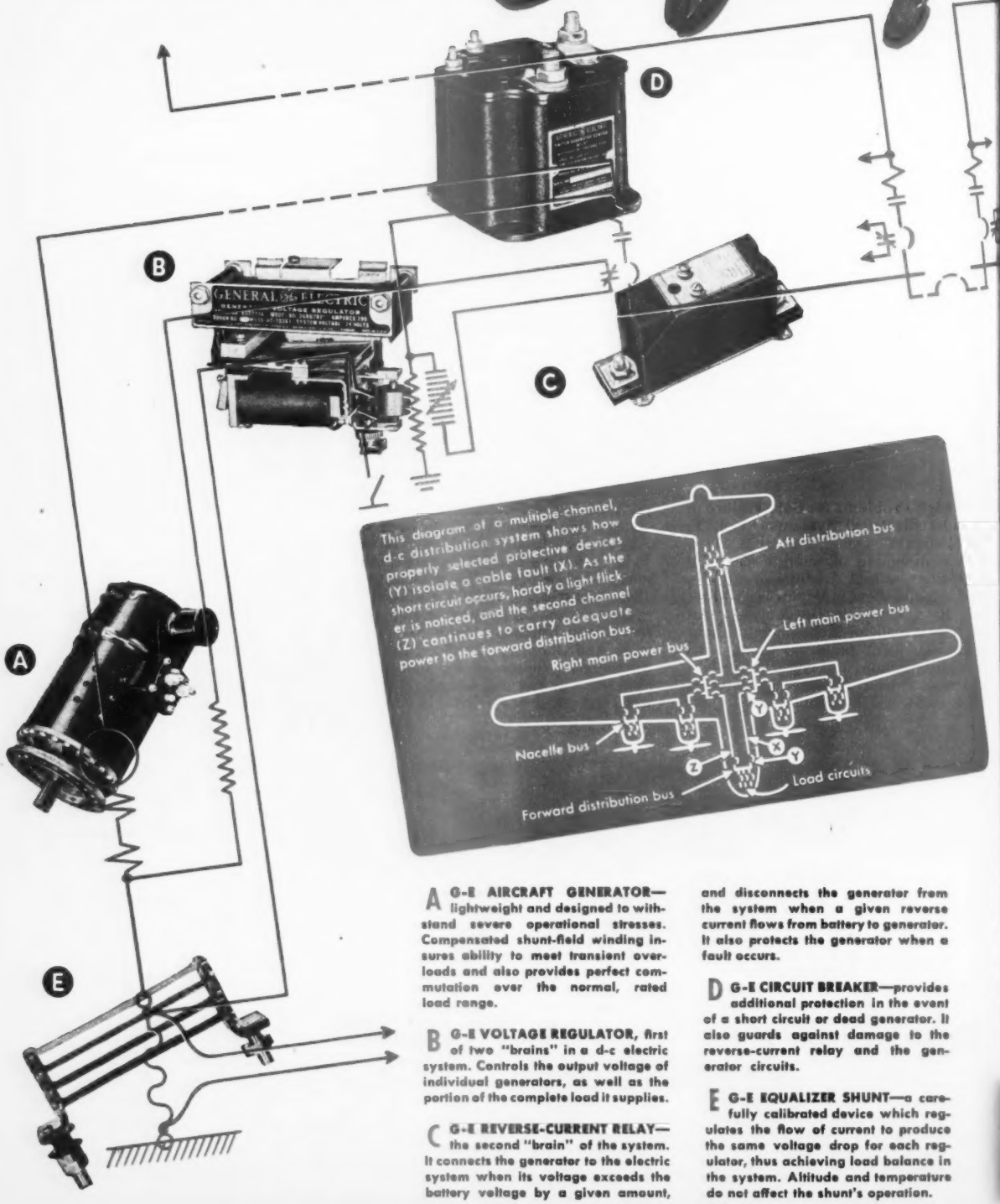
Fuel Injection for the Aircraft Engine. Part III. F. J. Wiegand and D. W. Meador. The application of fuel injection to aircraft engines is further discussed in this third installment of a four-part article. Attention is given to the design of a fuel-injection system and the calibration of an engine so equipped. The characteristics of the fuel-injection engine and the carburetor engine are compared and evaluated. Actual test data obtained with a modern fuel-injection aircraft engine are supplied. Sections of the article are given to mixture distribution, operating range, fuel economy, cooling, power, altitude performance, acceleration, induction ice, and starting. An appendix contains an evaluation of the effect of fuel evaporation in the combustion chamber. *Industrial Aviation*, October, 1945, pages 40, 42–44, 46, 77, 9 illus.

The Rolls-Royce Two-Stage Griffon. A comprehensive engineering study is made of the Rolls-Royce Griffon 65, a 12-cylinder aircraft engine representing the adaptation of the two-speed two-stage supercharger with inter-



Method of mounting detonation pickup on Allison engine and pattern obtained from single-cylinder engine.

HERE'S NEW Safety...


D
B
C
A
E
This diagram of a multiple-channel, d-c distribution system shows how properly selected protective devices (Y) isolate a cable fault (X). As the short circuit occurs, hardly a light flicker is noticed, and the second channel (Z) continues to carry adequate power to the forward distribution bus.
Aft distribution bus
Left main power bus
Right main power bus
Nacelle bus
Forward distribution bus
Load circuits
Y
X
Z

A G-E AIRCRAFT GENERATOR—lightweight and designed to withstand severe operational stresses. Compensated shunt-field winding insures ability to meet transient overloads and also provides perfect commutation over the normal, rated load range.

B G-E VOLTAGE REGULATOR, first of two "brains" in a d-c electric system. Controls the output voltage of individual generators, as well as the portion of the complete load it supplies.

C G-E REVERSE-CURRENT RELAY—the second "brain" of the system. It connects the generator to the electric system when its voltage exceeds the battery voltage by a given amount, and disconnects the generator from the system when a given reverse current flows from battery to generator. It also protects the generator when a fault occurs.

D G-E CIRCUIT BREAKER—provides additional protection in the event of a short circuit or dead generator. It also guards against damage to the reverse-current relay and the generator circuits.

E G-E EQUALIZER SHUNT—a carefully calibrated device which regulates the flow of current to produce the same voltage drop for each regulator, thus achieving load balance in the system. Altitude and temperature do not affect the shunt's operation.

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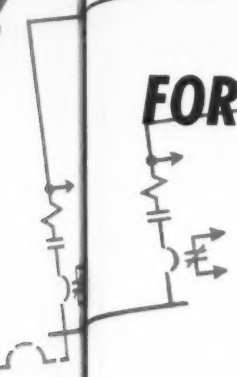

Developed for the B-29, this G-E power system makes four or more generators work as a balanced unit—gives a uniform flow of power under all conditions of flight.

Multi-engined airliners and cargo planes can now have a reliable, lightweight d-c electric system that will boost both the safety and simplicity of big-plane operation. With this new d-c system, you can make wider use of such modern electric apparatus as motors, heaters, instruments, and communication equipment. You get better protection for expensive devices and reduce down-time for maintenance. *Short circuits, no matter how serious, just can't "go places" and do damage.*

Developed for the B-29, this G-E system has conclusively proved its practicality on America's most highly electrified war plane.

Here are some of the advantages of the system over conventional single-generator systems:

UNFAILING POWER Normally, the system continuously splits the load among all of the generators. If one or more generators "kick out" for any reason, the system splits the load among the remaining generators so that they can handle the load without excessive voltage dips. Plenty of power is still available to operate instruments, landing gear, and other vital auxiliaries.

SHORTS STYMIED Although all generator circuits are closely co-ordinated, individual circuits become independent once trouble occurs. Short circuits are effectively isolated to hold damage to the minimum.

NO LIGHT FLICKER Despite wide variations in load during take-off and landing, all generators act in co-ordination to maintain extremely uniform voltage.

Aircraft manufacturers are turning, more and more, to General Electric for completely engineered systems, such as d-c or a-c power supply, ignition systems, and engine-temperature control. Their wartime experience has shown that they save time and eliminate many design headaches when they bring their electrical problems to G.E. in the earliest stages of their planning. May we do the same for you?

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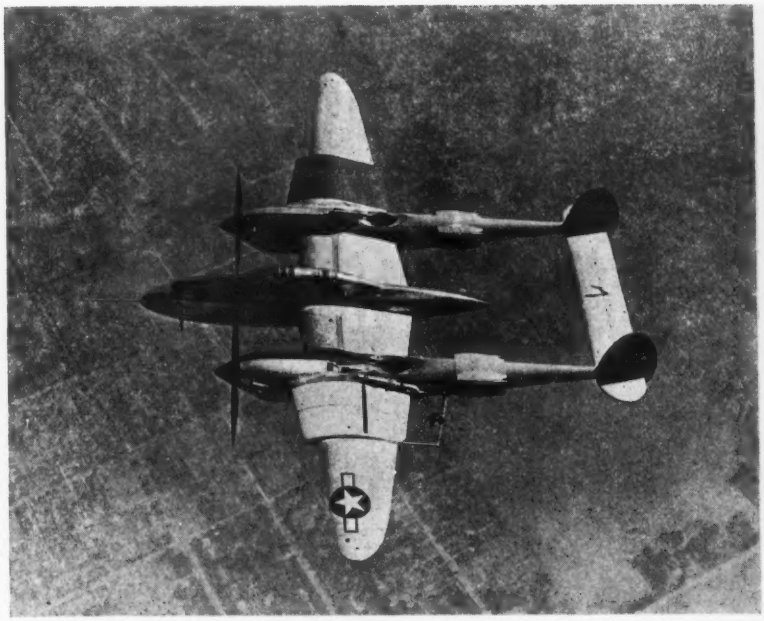
cooler, as developed originally for the Merlin 61 series, to the basic Griffon design. The design and construction of the engine are surveyed, its special features are analyzed, and a two-page schematic drawing is included among the illustrations that demonstrate its component parts. Information is particularized about high-altitude boost; ignition timing and automatic boost; general construction; internal arrangement; spring drive; wheelcase; supercharger; pistons, connecting rods, and valve gear; propeller drive; main cooling; and lubrication. General specifications, performance data, and other details for the 65 are listed in tabular form. *The Aeroplane*, September 21, 1945, pages 328–331, 334, 10 illus.

Lighter Engines from Stronger Alloys. Carl T. Doman. The applications and advantages of gray-iron alloys for aircraft-engine components are outlined. The incorporation of gray-iron into Franklin engines is illustrated and the following parts are described: an all-aluminum aircraft cylinder with a gray-iron liner; gray-iron cylinder barrels; a combination of cast gray-iron cylinder barrel screwed into an aluminum-cylinder head; and valve guides, valve seats, and oil pump gears from gray-iron castings. Advantages claimed for the gray-iron are those of performance, economy, and weight. A table indicates the metallurgic characteristics of Mocasco 50,000-lb. iron, while other tables offer an analysis of the alloys used in the discussed valve guides, intake valve seats, and oil pump gear. *Aero Digest*, October 1, 1945, pages 87, 88, 3 illus.

Power Prospect. The question of what type of power plant will be used to propel aircraft of the future is studied. Power-plant requirements for aircraft are defined. Consideration is given to the future of the conventional internal-combustion engine, jet propulsion, and the use of electricity, steam, and atomic energy for aircraft propulsion. *Flying Age*, November, 1945, pages 25–31, 55–59, 10 illus.

Tests and Checks Before Top Overhaul. Harvey A. Senior. It is noted that while the usual 20-hour inspection checks serve to keep an engine in good operating condition, a point is reached beyond which it is uneconomical to operate the engine because of high oil consumption and lack of power. A top overhaul then is required. It is stated that the usual length of service to be expected before need of a top overhaul develops is approximately 250 flying hours, but the exact time is best determined by a few simple checks. These tests are enumerated. *Aviation Service Magazine*, September-October, 1945, pages 28, 29, 32, 39, 5 illus.

The Mathis 42E 00. Descriptive data and specifications are given for a new French reciprocating-piston type of in-line engine. The engine has six banks of seven cylinders each, a normal power of 2,000 b.hp., and a maximum power of 2,300 b.hp. Advantages claimed for the Mathis 42E 00 include high power with good reliability, attributable to low mechanical and thermal stresses; small cross-sectional area for the power developed; low weight per horsepower; uniform cyclic distribution and smooth torque; perfect dynamic balance. A larger unit is contemplated to give a normal power of 4,000 b.hp. and a maximum of 5,000 b.hp. *Flight*, September 6, 1945, page 257, 1 illus.



The Lightning Swordfish, an experimental modification of a standard Lockheed P-38 fighter, fitted to test drag, lift, and airflow characteristics on any type of airfoil under actual flying conditions. Envelopes, or false wings, that cover a portion of the Swordfish wing are removable sections built with contours of exact proportions of any experimental wing proposed.

Flight Operations

Horsepower Sets Transport Economy. W. E. McClure. With the aid of charts, a study is made of the relationship of weight, fuel consumption, range, and pay load of the prewar type of airplane, and these factors are compared with those applying to the new types of transport aircraft. Operating costs are analyzed in relation to the cruising speed, power used, and other factors, showing that it is actually cheaper to fly the newer transports at higher speeds under most operating conditions. The advantages of gas turbines and the turbojet type of power plant are considered for applications where high power is required, it being stated that this type of power plant can be economical under conditions anticipated for the future, and that both reciprocating and reaction types will be used for commercial air-transport operations. *Air Transport*, October, 1945, pages 41, 42, 44, 47, 48, 6 illus.

Flight Technique

Handling the Seaplane. George B. Post. Part I of a two-part article on the operation of water-based aircraft. Several fundamental characteristics that form the basis for the wide differences between handling a landplane and a seaplane are described. The effect of a high wind force and centrifugal force when taxiing a seaplane is discussed. *Flying*, November, 1945, pages 44, 45, 92, 94, 4 illus.

Gliding and Soaring

The D.F.S. Reiher. B. S. Shenstone. The second and concluding part of an article describing the Reiher, a prewar German glider design. It is explained that the design of the wing was based on the wing design of two successful earlier sailplanes, the Sperber and the Fafnir II. A comparison of these two types with the Reiher is made.

Information is given about the design of the Reiher fuselage, controls, and tail. Performance and weight data are also supplied. *Soaring*, September-October, 1945, pages 4–7, 12 illus.

The Outlook for Gliders. Paul A. Schweizer. Future prospects for the glider are surveyed. It is stated that regardless of the success or failure of the cargo glider, there is no doubt of the future of gliding and soaring as a sport. Problems confronting the glider industry today are discussed. It is stated that these are not so much problems of design or production, but rather those of developing a market and educating and selling the public on this phase of aviation. Consideration is given to factors that have held back the sale of gliders; low-priced gliders; export possibilities; home-built gliders; glider kits; and the airport as a source of future sales. *Western Flying*, October, 1945, pages 61, 62, 1 illus.

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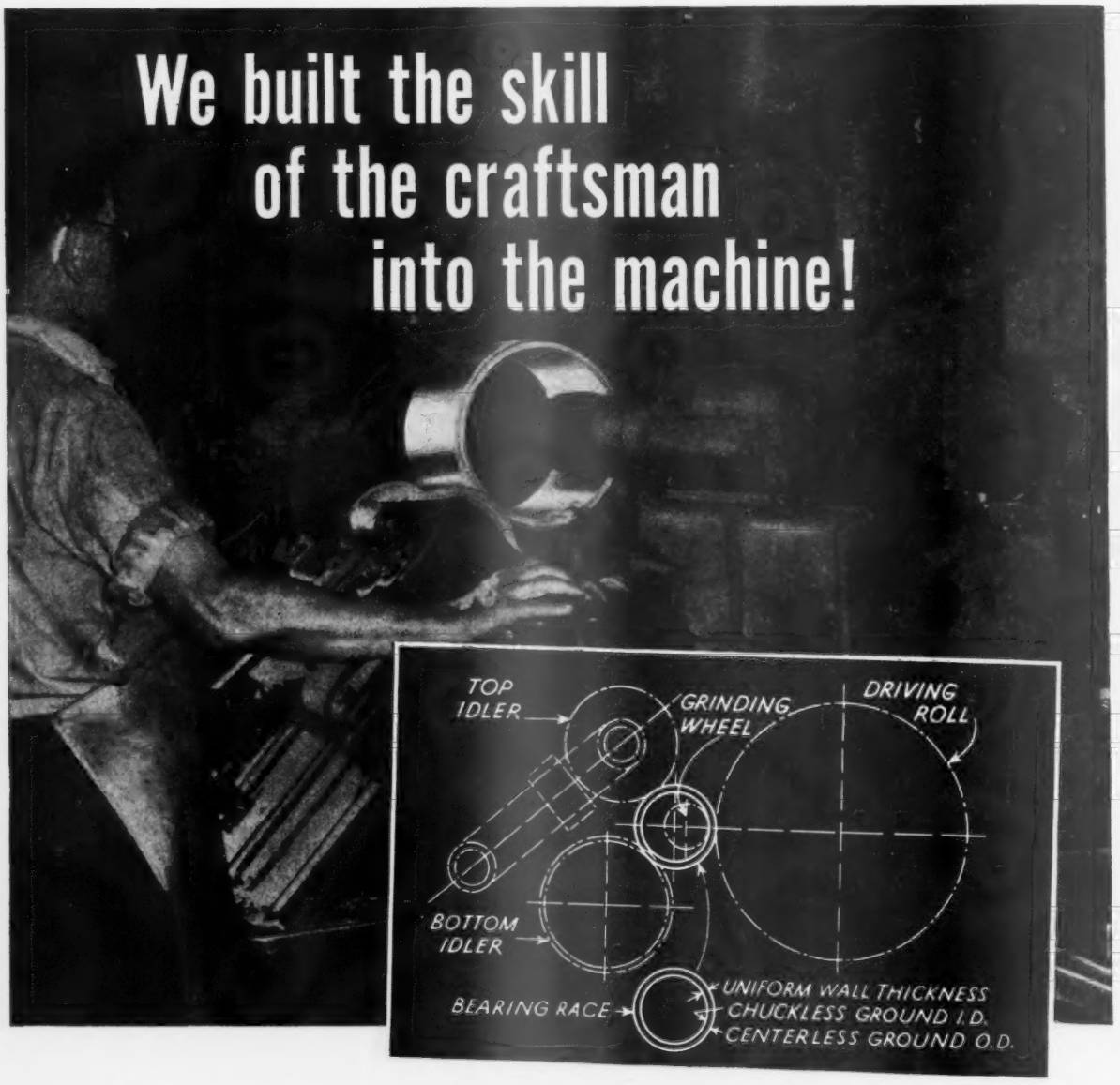

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HYATT ROLLER BEARINGS

Thermals at Low Altitudes. Karl O. Lange. It is noted that, in order to make more systematic and efficient attempts at catching thermals from an automobile tow or winch tow on level ground, three things have to be known: (1) what upcurrent velocities may be expected at low altitudes; (2) what is the circumference of a thermal near the ground; and, (3) where do the thermals generate. The results of an investigation of these problems are given in sections dealing with measurements of vertical velocity and horizontal size of thermals at 1,000 ft. above ground; the size or diameter of thermals at 1,000 ft.; the sources of thermals; vertical velocities at various altitudes and times required for the thermal to rise to those altitudes. *Soaring*, September-October, 1945, pages 10–13.

Aerodynamics of Glider Flight. Part I. W. Z. Stepniewski. After introductory remarks concerning the desirable features of the two main classes of gliders, defined as utility gliders and performance gliders, the writer explains the mathematical processes of determining the performance of a glider. He states that the speed polar diagram is considered the most important characteristic of a performance glider, and shows how it is drawn to indicate the sinking speed and the flying speed. Examples are given referring to different flying conditions, such as tail wind, head wind, ascending currents, descending currents, and combinations of these conditions.

Characteristics of the ideal performance glider are listed as (1) low minimum sinking speed; (2) high maximum gliding ratio; (3) the ability to fly slowly; and (4) the ability, on occasion, to fly fast, with the sinking speed only slightly increased (flat speed polar diagram).

Compromises necessary to adapt the ideal to practical considerations are outlined and formulas are given for computing the most satisfactory values. Several analytic methods are established or recalled which should enable the designer to evaluate the importance of different design parameters. The general considerations are applied by an example showing speed polar diagrams of two imaginary gliders. *Aero Digest*, October 1, 1945, pages 56–58, 97, 98, 10 illus.

Hydraulic Equipment

Aircraft Hydraulic Units. Part II. J. A. Oates. An account of the methods used in the production of various hydraulic aircraft units manufactured by Dowty Equipment, Ltd., is continued in this second installment of a three-part article. The current installment is concerned with the processes employed in the manufacture of a live-line pump that eliminates the need for automatic cutout or power valves and hydraulic accumulators. The design, manufacture, and testing of this equipment are described. The sequence of operations for machining important components of the unit is listed and a detailed account of the various machining operations is included. It is stated that this live-line pump has considerably simplified the equipment necessary for operating the landing gear of the Lancaster bomber and that it has many possible peacetime applications. *Aircraft Production*, October, 1945, pages 464–474, 30 illus.

Inspection

Some Conclusions Regarding Resistance Welding and Statistical Quality Control. John Bayard Butler. Inspection methods in connection with resistance-welding operations are examined. Two precautions are suggested to ensure that a group of items selected as samples for testing to destruction may be typical. The first is that all items must be susceptible to the same classifications, and the second is that the choice of a sample must be made without bias, and suggestions are made for obtaining this condition. Examination of resistance welding in the light of these conditions discloses no difficulties that would preclude the use of statistical quality control. The purpose of the paper is to show how the presence of predominant variables may be ascertained, and to present several examples of spot-welding data showing frequency distributions with no predominant variable. In one case a distribution with a predominant variable is shown. It is demonstrated that groups of spot welds containing over 100 welds can be made under the influence of no predominant variable. A detailed description is given of the methods employed and the results are recorded in several tables. *The Welding Journal*, October, 1945, pages 909–914, 4 illus.

Instrument Flying

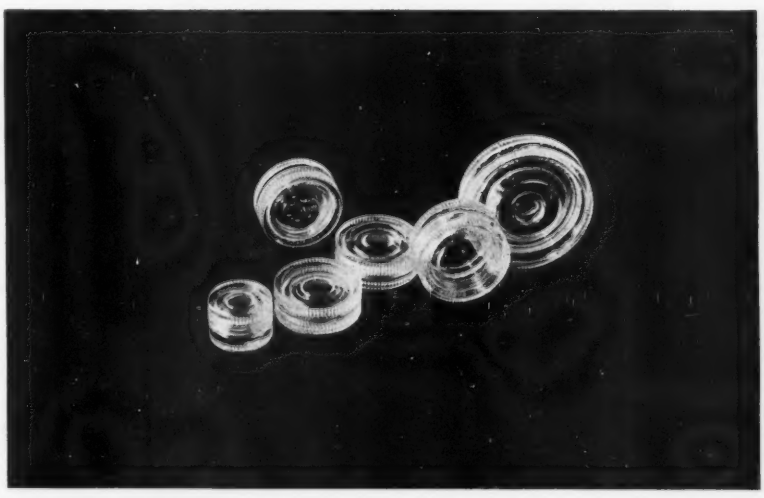
Needle, Ball and Imagination. Wolfgang Langewiesche. With particular reference to the right-and-left control of the airplane, various "systems" used for instrument instruction are analyzed. The realism of each system and its approximation to the way in which the pilot is eventually going to do his practical flying are evaluated. Principles, operation, advantages, and limitations of the "1-2-3" and "attitudes" systems are considered. Emphasis is placed upon the need for training the imagination in teaching a student pilot to fly "blind." *Air Facts*, November, 1945, pages 34–58, 6 illus.

Instruments

Private Plane Instruments. This article gives the results of an aircraft-instrument survey conducted by the Aircraft Owners & Pilots Association and sponsored by the Kollsman Instrument Division of the Square D Company. Five thousand questionnaires were mailed to pilots, plane owners, instructors, and flying service operators, to obtain their opinions regarding instrument requirements. Information gathered from 2,745 replies is classified. *Air News*, November, 1945, pages 30, 31, 10 illus.

Lubricants

Bearing Lubricant Progress Paced by Cooperative Research. A. F. Brewer. Research work performed by the laboratories of the manufacturers of ball and roller bearings and of lubricants is reviewed with regard to the improvements that have been effected in antifriction bearings and in methods of lubricating them. One of the important properties of a bearing lubricant is stated to be oxidation resistance, and the work done in overcoming the effects of oxidation is outlined. Resistance to rust caused by salt water is another important quality, particularly for bearings



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Transparent containers, molded of Lucite methyl methacrylate resin, hold the precision bearings used in the famous Norden bombsight. At the upper left a packaged bearing is shown prior to shipment completely submerged in transparent, protective oil. The new method of packaging provides complete protection against rust, and the containers can be reused at least ten times, according to the bearing manufacturer.

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in naval aircraft. The specifications of the Army-Navy Aeronautical Board for bearings and lubricants are summarized, as well as other tests. Extensive suggestions are made for the proper design of bearings and lubricating systems for them, and for the lubrication and maintenance procedures necessary to secure the most satisfactory results from such bearings in service. *Aero Digest*, October, 15, 1945, pages 60, 61, 114, 118, 120, 8 illus.

Marketing

Design for Shipment. Frank X. Mara. It is stated that airplane costs could be lowered if the manufacturer were to deliver planes disassembled to the distributor, via rail or truck. In an analysis of the f.o.b. method of delivery as compared with the f.a.f. method, economic advantages are claimed for the former, resulting in savings to manufacturer, distributor, and buyer. *Air Facts*, November, 1945, pages 11–14.

Keep Those Students Coming Back for More. William D. Strohmeier. Suggestions are made for the utilization of statistical methods in the sales-promotion work necessary to maintain a large volume of business for a flying school. Based on the experience of the Hawthorne Flying Service, it is noted that approximately 32 per cent of the number of new students drop out after the first lesson, 24 per cent take only two lessons, 21 per cent take three or four lessons, and only 23 per cent take more than six lessons. Suggestions are made of the establishment of a follow-up system by which efficient sales-promotion methods can be applied to retain the interest of the student and increase the number of those continuing their instruction. Forms used for keeping account of the student business and for this sales-promotion work are reproduced and explained. *Aviation*, October, 1945, pages 111–113, 2 illus.

Materials

Effect of Assembly Aging on the Properties of Several Aluminum and Magnesium Alloys. G. R. Bailey and Max E. Tatman. The writers attempt to answer some of the questions concerning the effects on the physical properties and corrosion-resisting characteristics of various materials and alloys that might comprise a production assembly, if artificially age-hardened with (1) the clad 24S aluminum alloys at 375°F. for 6½ hours; or (2) the new 75S at 250°F. for 24 hours. The major part of the article is devoted to a discussion of the miscellaneous materials or components that are of necessity attached to the assemblies prior to assembly aging. The data supplied were compiled by the writers from the results of extensive research and testing at the engineering test laboratories of Consolidated Vultee Aircraft Corporation, San Diego, over a period of 2 years. *Aluminum and Magnesium*, October, 1945, pages 24, 25, 29, 30, 2 illus.

Medicine

Studies on Bends. Capt. Hurley L. Motley, Capt. Herman I. Chinn, and Lt. Floyd A. Odell. A report on a study of bends carried out at Maxwell Field, Alabama, where over 9,500 cases of bends occurring in 68,422 trainees have been recorded and analyzed. Data are supplied on the incidence of bends in four kinds of simulated flights. The data obtained through these low-pressure flights are analyzed in sections dealing with environmental factors, constitutional factors, and the characteristics of bends. The conclusions reached through the study are summarized. *The Journal of Aviation Medicine*, August, 1945, pages 210–234, 7 illus.

Traumatic Calcifications: A Precipitating Factor in "Bends" Pain. Lt. Comdr. J. H. Allan. The nature of aeroembolism is reviewed and some of the factors that increase the incidence of bends are indicated. The writer describes five cases of calcific disturbances in which bends pain occurred either repeatedly in the area of calcification, or occurred at an altitude low enough to screen out other factors that cause production of the bends. A case is also reported in which bends occurred at a lower altitude than has been previously reported in any publication. It is indicated that calcific deposits and aseptic necrosis are predisposing factors in bends pain. *The Journal of Aviation Medicine*, August, 1945, pages 235–241, 5 illus.

The Relationship Between Physical Fitness and Success in Training of U.S. Naval Flight Students. Comdr. Ashton Graybiel and Lt. (j.g.) Howard West. In this study a comparison is made between physical fitness and success in flying of 1,076 U.S. Naval Flight Students at the School of Aviation Medicine, Naval Air Training Bases, Pensacola, Florida. One thousand completed the intermediate stage of training and 76 failed at this stage for reasons of poor flight performance. All of the students were originally selected for training only after passing a careful examination designed to exclude anyone who did not meet prescribed physical and psychologic standards. During the training course much attention was given to maintaining and improving the degree of physical fitness. Information is given about the physical-fitness and flight-performance measurements that were used in the analysis. It was found that within the range of physical fitness of the group of flight students in this study, differences in fitness had no relationship to flight performance. *The Journal of Aviation Medicine*, August, 1945, pages 242–249.

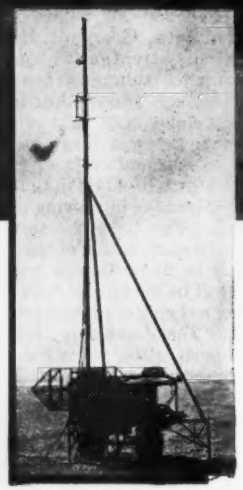
The Effect of Methylene Blue on Performance Efficiency at High Altitudes. Matilda Moldenhauer Brooks. The writer reports experiments carried out to determine whether methylene blue would produce any effect on the efficiency of performance tests at reduced oxygen pressures approximating those at high altitudes. The experiments were conducted in the low-pressure chamber of the Office of Scientific Research and Development at the University of Pennsylvania. The rate of performance in speed and accuracy was measured by a so-called pursuit meter and by decoding tests. Oxygen saturation of the blood was measured by the oximeter. It was found that in the majority of cases a decided improvement in the performance rate was obtained when adequate doses of methylene blue were taken and that the time when the medication was taken was an important factor. It is suggested by the writer that methylene blue be used in high-altitude flights. It is also suggested that benefits would be obtained by its use in high mountain climbing where oxygen tanks cannot be carried and where anoxia causes serious distress. *The Journal of Aviation Medicine*, August, 1945, pages 250–262, 5 illus.

Physical Fitness. George R. Harris. The writer calls attention to some of the commonplace things in medicine which seem to have become lost in the so-called "machine age" of medicine, with its complexities in diagnosis and treatment. Consideration is given to the physical fitness of pilots in different age groups. Means of improving fitness are explored. The hope is expressed that the yearly examination of the civilian pilot will be more than a routine, and that it will be viewed by both pilot and examiner as being of mutual interest and benefit. *The Journal of Aviation Medicine*, August, 1945, pages 263, 264.

A Combined Mixing and Flow Regulator. Morris Eckman and Alvan L. Barach. A device is described which will deliver any one of two predetermined rates of oxygen flow with either of two oxygen concentrations, by turning the handle of a petcock. A number of these regulators may be attached to a single oxygen pressure line in which the pressure is maintained constant. If the mask is equipped with an expiratory resistance, positive pressure may be provided in expiration, with either 50 per cent or 100 per cent oxygen in the inspired air. *The Journal of Aviation Medicine*, August, 1945, pages 265–267, 5 illus.

The Inhibition of Animal Metabolism Under Decompression. S. F. Cook. The writer sets forth evidence derived from isolated cells and from several groups of animals which appears to support the thesis that reduction of total gas pressure, quite independent of oxygen tension, alters the normal oxidation metabolism. It is stated that little is known about the biophysics of the process and that further investigation must be undertaken before the underlying cause of the phenomenon can be understood. *The Journal of Aviation Medicine*, August, 1945, pages 268–271.

Flatulence at Altitude in Presence of Cardiospasm. Lt. Charles B. Taylor and Francis J. Robinson. A case representing an extreme example of



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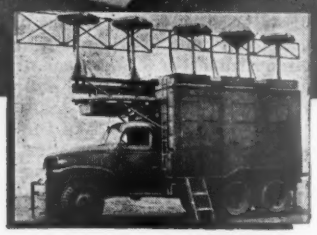

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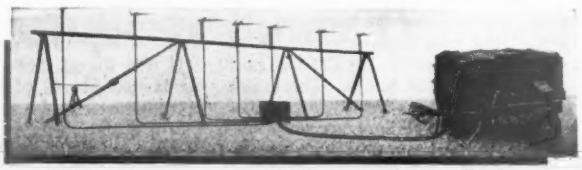

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abdominal distention caused by gas entrapped in the stomach is reported. Diagnosis of the condition was carried out with the aid of roentgenograms. The case was that of a medical officer and physiologist who experienced painful flatulence on some occasions when he ascended to a simulated altitude of 30,000 ft. or above. *The Journal of Aviation Medicine*, August, 1945, pages 272–274, 5 illus.

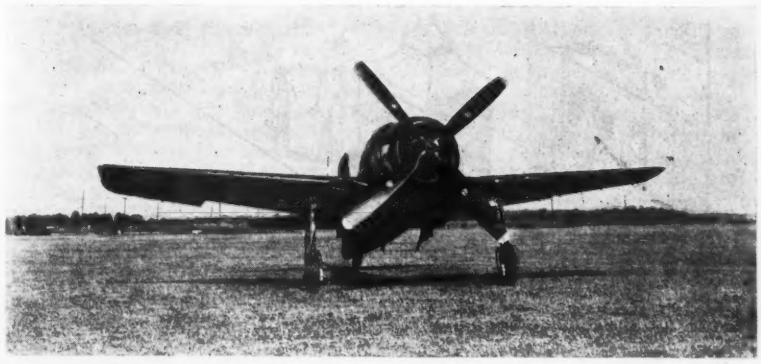
Arterial Spasm and Transient Paralysis Resulting from Lightning Striking an Airplane. James H. Currens. An unusual accident is reported in which three people were injured when lightning struck an aircraft on the ground shortly after it had landed. One person who was in contact with the aircraft had a transient paralysis of the right arm and leg associated with marked arterial spasm on the same side. The paralysis was considered to be a result of temporary ischemia of the peripheral nerves. It is stated that it seems wise to avoid standing beneath or close to an aircraft on an open field during an electrical storm, to avoid possible injury by lightning. *The Journal of Aviation Medicine*, August, 1945, pages 275–277, 1 illus.

Meteorology

The Use of Pressure Altitude and Altimeter Corrections in Meteorology. John C. Bellamy. A method is described which is stated to have been found convenient for the three-dimensional representation of the pressure and temperature fields in the atmosphere both for forecasting and for aircraft operations. The terms pressure altitude, altimeter correction, and specific temperature anomaly are defined and their physical interpretation is discussed. The hydrostatic equation, the geostrophic and gradient wind equations, and the thermal wind equations are stated in terms of these parameters.

All necessary tables and calculation diagrams, including a thermodynamic chart called the pastagram, are supplied. Applications of the proposed scheme to pressure-height computations, wind calculations, aircraft operations, and general synoptic analysis are given, together with a number of examples. *The Journal of Meteorology*, March, 1945, pages 1–79, 29 illus.

Observations of the Clouds and Weather During a Flight Over and Into the Gulf Hurricane of September 18, 1943. A report is given of observations made in a Gulf hurricane in a B-17 on a round trip from Oklahoma City. The crew of the plane consisted of three officers of the Army Air Forces and a Navy technician who took along a Navy aerometeorograph and obtained a record during the descent of the plane from above the storm at 30,000 ft. down into the eye as far as 12,000 ft. and out through the side of the storm. *Bulletin of the American Meteorological Society*, September, 1945, pages 271–273.



Grumman Aircraft Engineering Corporation's F-8-F Bearcat. The airplane is powered by a 2,100-hp. Pratt & Whitney engine able to develop 2,800 hp. with water injection and is equipped with a four-bladed General Motors Corporation Aeroproducts propeller.

Military Aviation

A Case for the Turret Fighter. J. L. Beilschmidt. The writer states reasons that may justify the future use of turreted fighters in large-scale tactical combat operations against bombers. Advantages of the turret fighter are described and evaluated. Consideration is also given to the disadvantages of this type. A proposed three-turret fighter is described and illustrated. *Aeronautics*, October, 1945, pages 38–41, 5 illus.

Naval Aviation

Clear Upper Deck. B. J. Hurren. Although it encompasses a brief review of the evolution of British aircraft carriers from the prewar conversion types to the latest models, this article is concerned mainly with details of an intermediate class of British aircraft carrier. Called the Light Fleet Carrier, this type includes such craft as the "Venerable," "Vengeance," "Glory," "Colossus," "Leviathan," "Powerful," and "Ocean." With a displacement of 14,000 tons and a top speed of 25 knots, this type carries a complement of 33 aircraft made up of attack, reconnaissance, and fighter planes. One of the features of the Light Fleet Carrier to which attention is called particularly is the absence in its design of guns and gunner paraphernalia along the sides of the flight deck. *Flight*, September 6, 1945, pages 260–262, 2 illus.

Paints and Coatings

Chromium Plating of Aircraft Parts. C. L. Savage. The application of hard chromium to aircraft hydraulic parts is the subject of this article. It is stated that because regulation of practice and deposition methods in out-of-plant production is generally impossible, it is a better procedure to conduct plating operations inside the aircraft plant. Emphasis is placed on the importance of providing a smooth surface for the application of the plating. The plating operational sequence as carried out in the electroplating department of the Douglas Aircraft Company is described. *Industrial Aviation*, October, 1945, pages 37–39, 71, 72, 13 illus.

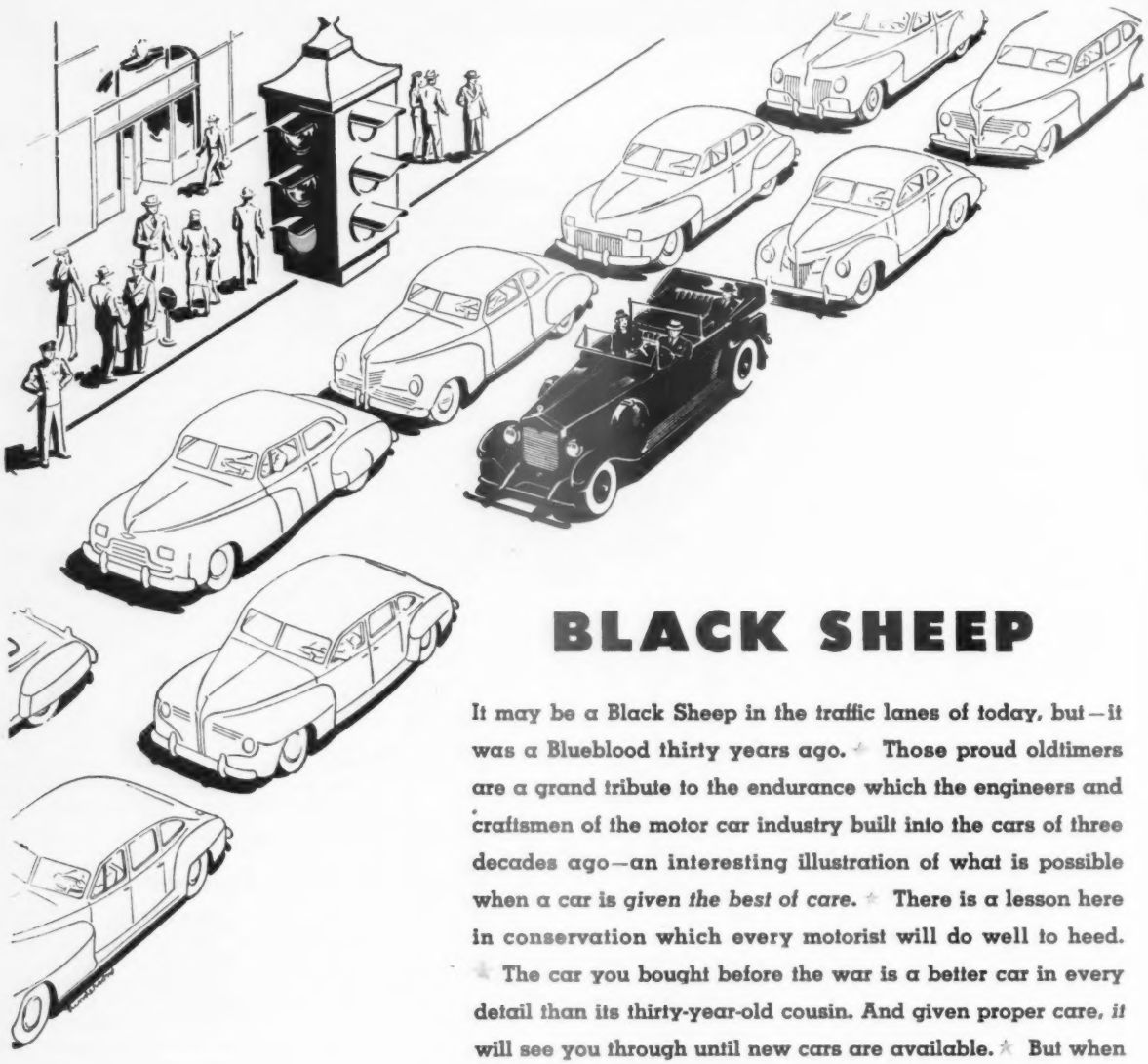
Alrok Treatment Avoids Masking Cast-In Inserts. A. J. Ferko. It is noted that aluminum-alloy castings with cast-in inserts of a dissimilar metal cannot be anodized unless the inserts are masked. Tests conducted by the Boeing Aircraft Company are reported which indicate that castings of aluminum alloys 40E, 195, and 356 with cast-in inserts need not have the inserts masked when given the Alrok treatment. Results of the tests are tabulated. *The Iron Age*, October 11, 1945, pages 69, 70.

Personalities

Mr. Piper of Cub-Haven. Lincoln Barnett. In this biographic sketch the career of William Thomas Piper is traced. Information is given about his early life and later activities as President of the Piper Aircraft Corporation. What this organization is accomplishing under his guidance is described. *Life Magazine*, October 29, 1945, pages 67–72, 3 illus.

Mr. Airforce. John Marvan. Gen. H. H. Arnold is the subject of a biographic article. It is noted that he began his military career in the same year that the Wright Brothers made the airplane a reality at Kitty Hawk. The writer outlines General Arnold's educational background and reviews his military activities and achievements. *Air Trails*, November, 1945, pages 26–28, 93, 3 illus.

Doctor of the Air. Flt. Lt. F. A. Walbank. A biographic sketch of Air Marshal Sir Harold Whittingham, Director-General of Britain's Royal Air Force Medical Services. Sir Harold's educational background, his professional activities and achievements, the progressive increase in his responsibilities and advancements in rank are traced. Mention is made of the conferral upon him of the John Jeffries Award for 1944 by the Institute of the Aeronautical Sciences. *The Journal of Aviation Medicine*, August, 1945, pages 278–280, 1 illus.



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It may be a Black Sheep in the traffic lanes of today, but—it was a Blueblood thirty years ago. ★ Those proud oldtimers are a grand tribute to the endurance which the engineers and craftsmen of the motor car industry built into the cars of three decades ago—an interesting illustration of what is possible when a car is *given the best of care.* ★ There is a lesson here in conservation which every motorist will do well to heed. ★ The car you bought before the war is a better car in every detail than its thirty-year-old cousin. And given proper care, *it* will see you through until new cars are available. ★ But when you *are* able to buy your next car, you'll find still finer styling, still better operating efficiency, new ideas in design, higher standards of precision, and better all-round performance. ★ *Automotive engineers are constantly improving the transportation of America.* It is a privilege to have worked so closely with these men through two wars and the years between.

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Personnel

The Merchant Air Crew. Part I. Erik Nelson. First half of a two-part article on flight personnel requirements for transport aircraft advises on the selection, training, and employment of air-crew members. A table indicates all the duties that are required to be fulfilled on board a merchant air liner, together with the relationship between the various jobs. The scope of each person's duties is defined broadly. Composition of the air crew is listed as the following: Commander, Power Control Engineer, Navigator, Pilot, Telegraphist, Flight Engineer, Purser, Clerk, Chef, and Steward.

General physical, educational, and preliminary training requirements are outlined in the discussion of air-crew selection. In the consideration of training and training syllabus, the jobs are classified under operational crew, "services" crew, and commercial crew groupings.

Four types of merchant air-line operation are differentiated in connection with their flight personnel requirements. These are classified under local services, intercity services, main line services, intercontinental or trunk lines. *The Aeroplane*, October 5, 1945, pages 394–397, 1 illus.

Plastics and Plywood

New Bonding Process. A wet abrasion process is described as a simple technique for bonding laminated or molded products of the phenolic or urea types without the necessity for using heat. The method consists in abrading the surface to be bonded in the presence of a special phenolic resin before applying the appropriate cold-setting cement. Figures are given to show the stress to which such joints can be subjected before failure. The test methods used are detailed with respect to lap joints and butt joints. Instructions are given for the preparation of the surfaces. *Aircraft Production*, October, 1945, pages 495, 496, 3 illus.

Private Flying

What the Private Owner Does Want! Ernest P. Brodie. A survey of American and British airplanes that are likely to be available in the immediate future for the private pilot. Accompanying the survey are comments of the writer about each plane and how it complies with general requirements of the private owner. A tabulation lists the planes according to 17 different classifications. *Flight*, September 13, 1945, pages 275–277, 9 illus.

Production

Stamping and Deep-Drawing Magnesium. J. Walter Gulliksen. The writer discusses some of the factors that should be considered in the design of magnesium stampings and deep-drawn parts to take the fullest advantage of present fabricating techniques. Illustrations show different types of parts, varying from simple flat stampings to the latest development in this field—heavy gage domes that require "ironing," indenting, upsetting, and sizing in addition to the conventional draw-press operations. Data on punching, blanking, bending, forming, and drawing operations are included and case histories are supplied. Tables give properties and other data about magnesium sheets. *Product Engineering*, October, 1945, pages 687–691, 11 illus.

Corrosion Resistance of Heat Treated 24S Aluminum Alloy. Charles Nagler. It is noted that before aluminum alloys can be heat-treated for use in products for the armed forces, the equipment and operations used must pass a certification test. In carrying out the certification test for a number of heat-treaters, it was found that the 24S (Cu 4.6, Mn 0.6, Mg 1.5, Al remainder) alloys would meet the minimum requirements for tensile and other physical properties, but would subsequently fail in the salt-corrosion test. This condition was found most prevalent in the 0.025-in. thick sheet, and also was found to occur in sheets of 0.125-in. but to a lesser degree. It is indicated that the length of time necessary to transfer the alloys from the heat-treating bath to the quench tank was the cause of the difference in the corrosion resistance. Details are given about an investigation of the subject. *Aluminum and Magnesium*, October, 1945, pages 26–29, 10 illus.

Plaster Mold Castings. N. B. Barnard. The development in recent years of a method of drying plaster quickly is credited with making possible the use of plaster casting investment for industrial castings in which close tolerances and other properties are required. The method and the material used at the Briggs Manufacturing Company are described. The advantages are outlined, including cost reduction through elimination of scrap; reduction of machining; simplified tooling; avoidance of cooling stresses; and adaptability to intricate designs. Several typical applications are explained and illustrated, one of them being a gimbal ring for a gyroscope. It is suggested that the process may be employed for an extensive list of other uses. The materials used for plaster-mold castings are tabulated. *Materials & Methods*, October, 1945, pages 1085–1089, 9 illus.

In Germany Today. G. Geoffrey Smith. Impressions of current German industrial conditions feature the first part of an article giving observations regarding German aviation developments. Among items upon which comment is made are German research methods and equipment; training schools, methods, and equipment; projected aircraft types; antiaircraft rockets; experimental aircraft-engine design.

Part II includes reportorial notes on the Ruhr aluminum works, a summary of Germany's jet-propulsion activities, and a comparison of Allied and German aircraft construction progress. Features of German aircraft equipment are discussed. *Flight*, September 27, 1945, pages 333–337, 13 illus.; October 4, 1945, pages 357–361, 11 illus.

Magnesium Die Castings. Max Powell and C. H. Scott. In this article on the production of high-quality magnesium die castings, the writers examine the factors that must be considered if the full benefit of the die-casting process is to be obtained. Aspects of the method dealt with include the parting line, draft, tolerances, stationary and movable cores, wall thickness, cast threads, machining allowances, ejectors, inserts, size and weight limitations, porosity, and shrinkage. Design data for magnesium die castings are supplied. *Product Engineering*, October, 1945, pages 692–696, 6 illus.

Fabricating Aluminum Alloy Sheets. Patrick Flynn. A method of fabricating aluminum-alloy sheets is described, by which a single part may be used in place of a conventional assembly in locations where stress and weight considerations have indicated a built-up section of skin and doublers. With this type of construction a wing skin can be tapered spanwise and chordwise, or have several spanwise tapers, with the chordwise thickness reduced in a series of steps. Information is given about the planer-duplicator machine used in this process. *Industrial Aviation*, October, 1945, pages 27, 76, 77, 2 illus.

Car Production Principles as Applied to Aircraft. B. G. L. Jackman. In this article, which is one of a series, further consideration is given to the utilization of the facilities of automobile manufacturers for the production of aircraft components. Protective treatment and surface finish, and the use of spot-welding technique to provide smooth surfaces are discussed. Other sections refer to time study, the categories of labor involved in the construction of automobiles and aircraft, production costs, and maintenance. *Sheet Metal Industries*, October, 1945, pages 1769–1772, 4 illus.

Conveyor Line for Large Wing Sections. D. N. Driese. Details are given about the method of conveyer-line handling of Privateer wing sections developed by the Consolidated Vultee Aircraft Corporation. It is explained that the PB4Y-2 wing center section is more than 60 ft. long and weighs approximately 5,000 lbs. In the past, conveyer-line handling of wing sections of this size was accomplished through the use of track-guided dollies upon which were built suitable bucks for supporting entire wing assemblies. Tracks, dollies, and bucks presented serious handicaps to high-speed production by their interference with large areas of the wing's

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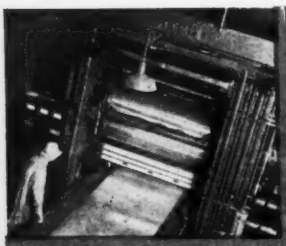

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lower surfaces. How these conditions were eliminated by the use of a rotating mount system is described. *Western Flying*, October, 1945, pages 72, 73, 5 illus.

Design of Magnesium Forgings. A. L. Rustay and F. B. Rote. The writers describe how a new production method has affected the design and qualities of magnesium-alloy forgings. Using both the press and hammer, the new techniques make it possible to produce more forgings from existing equipment. Sections of the article discuss the mechanical properties of magnesium alloys for forgings, the heat-treatment of magnesium forgings, forging test results, the forging of cast blanks, and the cost of magnesium forgings. *Product Engineering*, October, 1945, pages 682–686, 8 illus.

Milling Heavy Sections of 14ST Aluminum Alloy. An account of the way problems connected with the production of large wing spars from forged or extruded sections of the strongest aluminum alloys were solved. The work called for a heavy-duty, rigid, milling machine with adequate power to turn straddle milling cutters at extremely high speeds and at a relatively high rate of feed. The Onsrud heavy duty milling machine was used. Information is given about research involved in the designing of cutters to make the maximum use of the machine's production potentialities. *The Iron Age*, October 18, 1945, pages 62, 63, 2 illus.

Shotpeening. Henry Fischbeck and Phil Schmitt. Applications of the shotpeening process for increasing the life of parts are described, with particular reference to the methods used at the East Hartford plant of the Pratt & Whitney Aircraft Division of United Aircraft Corporation. It is stated that shotpeening has become standard practice at Pratt & Whitney on certain rocker arms, aluminum pistons, valve-spring washers, articulated (or link) rods, around holes and counterweight cheeks on crankshafts, and on many gears including the high and low-ratio clutch oil vent gears. Experiments are being conducted on other parts such as crankcases. Sections of the article are devoted to the basic principles of the process, the equipment for shotpeening, and the settings for shotpeening rocker arms. *Materials & Methods*, October, 1945, pages 1064–1068, 9 illus.

Manufacture of Close Tolerance Bolts. A description of how close tolerance bolts and screws for aircraft are manufactured by the National Screw and Manufacturing Company. From the analysis of the raw material to the final inspections, the procedures related involve 20 separate manufacturing operations and seven inspections. Data are included about the machines used in the production of the bolts and screws. *Aero Digest*, October 1, 1945, pages 66, 67, 4 illus.

Radio

Bomber's Radar. C. B. Bailey-Watson. With details about how they operated and the ways in which they were employed, the three primary types of radar systems used by the Royal Air Force for bombing action against Germany are reviewed. The "Gee" system is described as a navigational aid by means of which the aircraft's position may be determined at any time to a fairly high order of accuracy. Essentially, it consists of a series of ground stations which are constantly transmitting sheets of radio signals, emanating in hyperbolic lines of individually constant signal strength over a wide area. The "Oboe" system is noted as the one first used by the Pathfinders. This method makes use of two ground stations—one a "releasing" station, the other a "tracking" station—and its signals are purely aural. The "H2S" system is the "genbox," completely self-contained in each aircraft and having no relation whatsoever to ground stations. *Flight*, September 6, 1945, pages 252–254, 3 illus.; "Use of GEE Radio in Air Navigation," by Lt. Raymond LeKashman, *Aero Digest*, October 1, 1945, pages 64, 65, 138, 140, 142, 145, 4 illus.

Should You Scrap Your Radio? Oliver Read and Kurt Rand. Changes in frequency assignments for fliers will soon make many two-way radios obsolete. The question of whether transmitters and receivers should be replaced or modified to meet the new conditions is examined, and the advantages and disadvantages of the changes in frequency bands are considered. The article gives the opinions of two writers. One is favorable to the change because he believes the frequency assignments will provide benefits outweighing the financial losses in replacing present plane sets. The other sees objections to the change because of transmission problems and the cost of new radios. *Flying*, November, 1945, pages 24, 25, 100, 102, 108, 109, 2 illus.

Radio Instrument Approach. S. S. Stevens. Technical aspects of radio and communication in Canadian air transport are further discussed in this third article in a series. Information is supplied about the C.A.A. (SCS-51) instrument-approach system, which the Department of Transport plans to introduce in Canada. The advantages of

A gear about to be shotpeened at the East Hartford Plant of the Pratt & Whitney Division of United Aircraft Corporation.

this system and its limitations to commercial air operations are outlined. *Commercial Aviation*, September, 1945, pages 46, 48.

Radio Service and Maintenance for Personal Aircraft. Lawrence LeKashman. Points to be observed in the purchase of radio equipment for a private airplane, as well as in the maintenance of such equipment, are outlined. After listing six questions that the purchaser should ask with reference to the construction of the radio and the maintenance required, the writer reviews the causes and remedies for aircraft-radio troubles. He emphasizes the necessity for frequent and reliable inspection of the radio equipment to prevent failures during flight or when landing at airports where complete radio-repair facilities are not available. More than half of the equipment failures are attributed to defective tubes, while proper installation can minimize the second largest cause of radio troubles.

It is suggested that properly equipped and efficiently operated radio service shops can render important service and develop profitable business as an adjunct to a well-operated airport. Comments are made about the discrepancies in existing license requirements for aircraft radio operators and about ways in which radio operation and maintenance can be improved. *Aero Digest*, October 15, 1945, pages 70–72, 110, 4 illus.

The Design of Broad-Band Aircraft-Antenna Systems. F. D. Bennett, P. D. Coleman, and A. S. Meier. In this paper a complete technique for the development of broad-band aircraft antennas is described. Information is given about a coiled-line impedance-measuring system that has been used in the design of aircraft antennas at the Aircraft Radio Laboratories, Wright Field. The paper is divided into three sections which are devoted to antenna-impedance measurement in aircraft; the design of reactance-matching sections for antenna; and the development of broad-band wire antennas for aircraft. *Proceedings of the I.R.E.*, October, 1945, pages 671–700, 67 illus.

Reaction Propulsion

Bombers or Rockets? A. V. Cleaver. As a sequel to another article which discussed the comparative merits of bombardment by pilot-controlled aircraft and by rocket planes in future wars, this is a speculative consideration of how the question might be affected if atomic energy could be utilized for the propulsion of rocket projectiles. By means of mathematical calculation, the writer tries to evaluate the sort of powers and velocities that might be expected under such development. He demonstrates the "economy" of rockets using atomic energy and also gives reasons in justification of his assumption that atomic energy could be used for reaction propulsion. In addition to the military uses of rocket projectiles, their potentialities are discussed also for ultra-high-speed terrestrial transportation, for providing stations for many purposes above the earth's atmospheric limits, and for interplanetary travel. *Flight*, September 6, 1945, pages 263, 264.

Nazi Jet-Bats Which Never Took Wing. Erwin J. Bulban. Based on information uncovered by Technical Air Intelligence engineers who have been studying German scientific developments, descriptions are given of several types of German jet-propelled flying-wing aircraft designs that were in preparation at the end of the war. Three fighter airplane designs from the Gotha works were designated as P-60A, P-60B, and P-60C. Brief descriptions are given of these three designs, with regard to their dimensions, power plants, wing sections, landing gears, etc. Among the unusual features planned were the use of leading-edge flaps and combination elevators and ailerons, which are called "elevons." Reasons for the location of the power plant are deduced. It is stated that from available evidence it appears that no full-scale aircraft of any of these types was ever built or flown. *Aviation*, October, 1945, pages 172, 173, 3 illus.

German Jet Rivalry. From material released by the British Air Ministry, additional data are given on ex-

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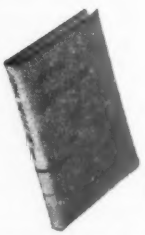

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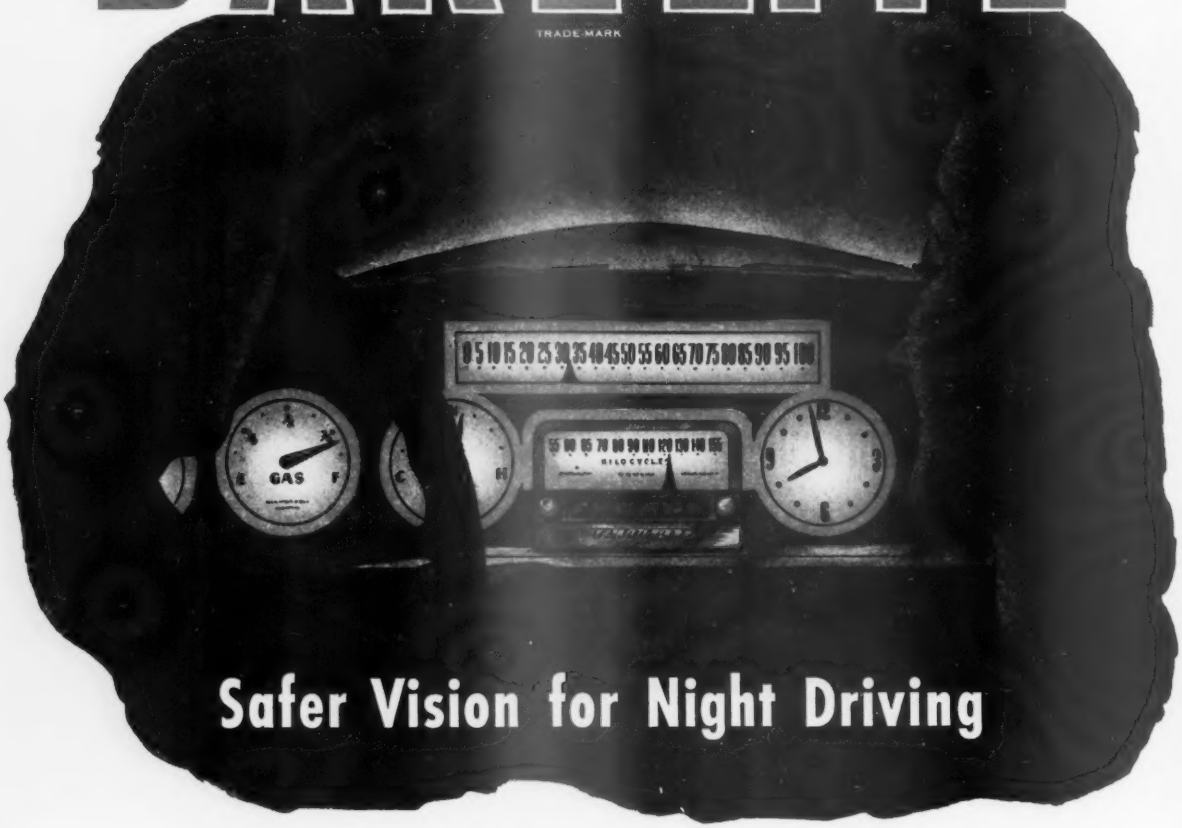

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isting and projected German turbine-jet units and aircraft. The information includes details pertinent to the He 178 with an He S3 turbojet unit; He 280 with two S3 units; Heinkel-Hirth 011 unit with two-stage turbine; 003 unit with seven-stage compressor; Ju 004 unit with eight-stage axial compressor; Ju 012 unit with eleven-stage axial compressor and two-stage turbine; BMW 018 unit with twelve-stage compressor and three-stage turbine; and 007 turbojet unit developed for the Daimler-Benz concern.

Particulars are also included relative to the conversion of the BMW 018 unit for driving counterrotating propellers; the Arado 234B and 234C; Ju 287; Me 264; and TA 400. The opinion is offered that German efforts toward jet propulsion development lacked coordination and unified direction. *Flight*, September 13, 1945, pages 282–284, 8 illus.; "German Aeronautical Development," *The Aeroplane*, September 14, 1945, pages 311–313, 4 illus.; September 21, 1945, pages 342, 343, 5 illus.; October 5, 1945, pages 387, 388, 5 illus.

Deflex-Reaction Propulsion. F. Umpleby. In a theoretic consideration of what is called an unorthodox method of increasing jet efficiency, the writer explains some of the elementary principles involved in axial-flow propulsion machinery. The writer likens the flow to that of a river in which a change in the section of the river bed is said to illustrate axial fluid reaction, and the washing away of the river bank as it sweeps around a bend illustrates the effect of bend reaction. In considering these forces in detail simple formulas are developed, and the actions and reactions of the gases are illustrated by means of simple velocity or force diagrams, drawn to scale. These diagrams are explained and the explanations are then combined into an example illustrative of practical designs for increasing the efficiency of reaction-propulsion power units. The explanation traces the complete flow path of the gas stream through the machine, together with the reactions generated.

The mathematical investigation of the individual and collective reactions that occur are worked out with the aid of formulas from which the resultant thrust components are computed. Curves are plotted to show the effects of variations in thrust during flight in an aircraft speed range from zero to 650 m.p.h. at sea level. From these curves a number of more promising features of this system of propulsion are indicated.

It is shown that fuel consumption is reduced and available thrust is increased for both take-off and for climbing. It is concluded by the writer that with the deflection-propulsion plant operating at its maximum performance within the given speed range, it is possible to operate commercial and private aircraft of the lighter types successfully on nonvolatile fuels. *Flight*, September 13, 1945, pages 287–289, 6 illus.

Rotating Wing Aircraft

Helicopter Training . . . Proving Ground for Progress. Tom Ashley. Impressions gained in a visit to the helicopter training center of the Army Air Forces are related. It is stated that the rigorous training schedules at Shepard Field, Texas, have proved a number of points which formerly were the basis of misconception or misunderstanding. It is reported that no accidents or serious injuries have been suffered by Army instructors or trainees, and that the training records prove helicopters can be safely landed in case of engine failure. Information is given about pilot training and the progress in helicopter design. It is stated helicopter maintenance, a major problem that must be solved before this type of aircraft becomes practical for commercial and private flying, has been sharply reduced. *Southern Flight*, October, 1945, pages 38, 39, 80, 7 illus.

Phases of Helicopter Control of Rigid and Semi-Rigid Rotor Blades. Ralph W. Allen. The purpose of the investigation reported was the determination of the phase angle between the blade position of maximum flapping and maximum control application for all ranges of stiffness and weight of a rigid or semirigid helicopter rotor blade. Suggestions are given for developing the moment equations, considering first the condition of hovering or near-hovering where the tip-speed ratio is negligible. The mathematical processes are worked out to the solution of an equation that expresses the relation between the azimuth angle of minimum flapping with variations of azimuth angle of minimum pitch application and the blade rigidity. The equation is plotted for various blade stiffnesses in one graph, and the phase angle is plotted against the blade stiffness in another graph, the phase angle being defined as the angular difference between the azimuth angle of maximum flapping position and the maximum azimuth angle of blade-pitch setting or control application. The phase relation is shown diagrammatically under given conditions that demonstrate the writer's conclusion that the phase relation is dependent upon the stiffness of the blade. *Aero Digest*, October 1, 1945, pages 60, 61, 3 illus.

Stress Analysis

An Acceleration Damper: Development, Design, and Some Applications. Paul Lieber and D. P. Jensen. In this paper, which deals with the solution of a vibration problem, the mechanism and theory of the acceleration damper are discussed. The theory yields formulas from which the acceleration damper can be designed efficiently for specific application. Theory and procedure for calculating the motion of a mechanical system, as influenced by a given acceleration damper, are developed. Tests are described which reveal good agreement between theory and experiment. These results show that friction forces acting on the mass particle are detrimental to the efficiency of the damper. A method for calculating the effect of the acceleration damper on flutter is also developed, which is accompanied by numerical results related to an actual airplane. It is indicated that the acceleration damper may have fundamental and numerous applications, some of which are in fatigue testing, helicopter vibration control, aircraft vibration control in general, and facilitating flight testing for flutter without endangering aircraft. *Transactions of the A.S.M.E.*, October, 1945, pages 523–530, 15 illus.

Locating Initial Failure in Static Test Specimens. Richard W. Powell. The problem of locating the origin of failure in aircraft structures under tension test is investigated. Reference is made to ordinary techniques for obtaining data of this nature which have proved to be rather unsatisfactory. It is stated that an ideal instrument for this type of measurement should start to record at the instant of initial failure (or slightly before), should be reasonably portable, simple to operate and install, and should have no effect on the strength of the structure. A failure-sequence indicator which is said to incorporate most of these features is described. It is stated that the device has been used on static tests of aircraft structures involving 24S-T, 24S-T86, and Plexiglas structures, and in each instance the data obtained were wholly consistent and apparently valid. *Automotive and Aviation Industries*, October 15, 1945, pages 28–30, 6 illus.

Structural Testing

Modern Experimental Work on Aeroplane Structures. A. G. Pugsley. An extensive survey is made of present-day experimental work on airplane structures. Experimental work carried out at the Royal Aircraft Establishment is described. The writer reviews early experiments and testing methods in structural engineering and proceeds to a detailed study of modern laboratory work on complete airplanes and large components, such as wings and tail surfaces, and the effects of the tests on the skin material. He describes the equipment and the results of tests for stiffness and resonance. Taking up the laboratory work on small components and research specimens, he outlines test methods for individual panels, detailing the equipment used in the tests.

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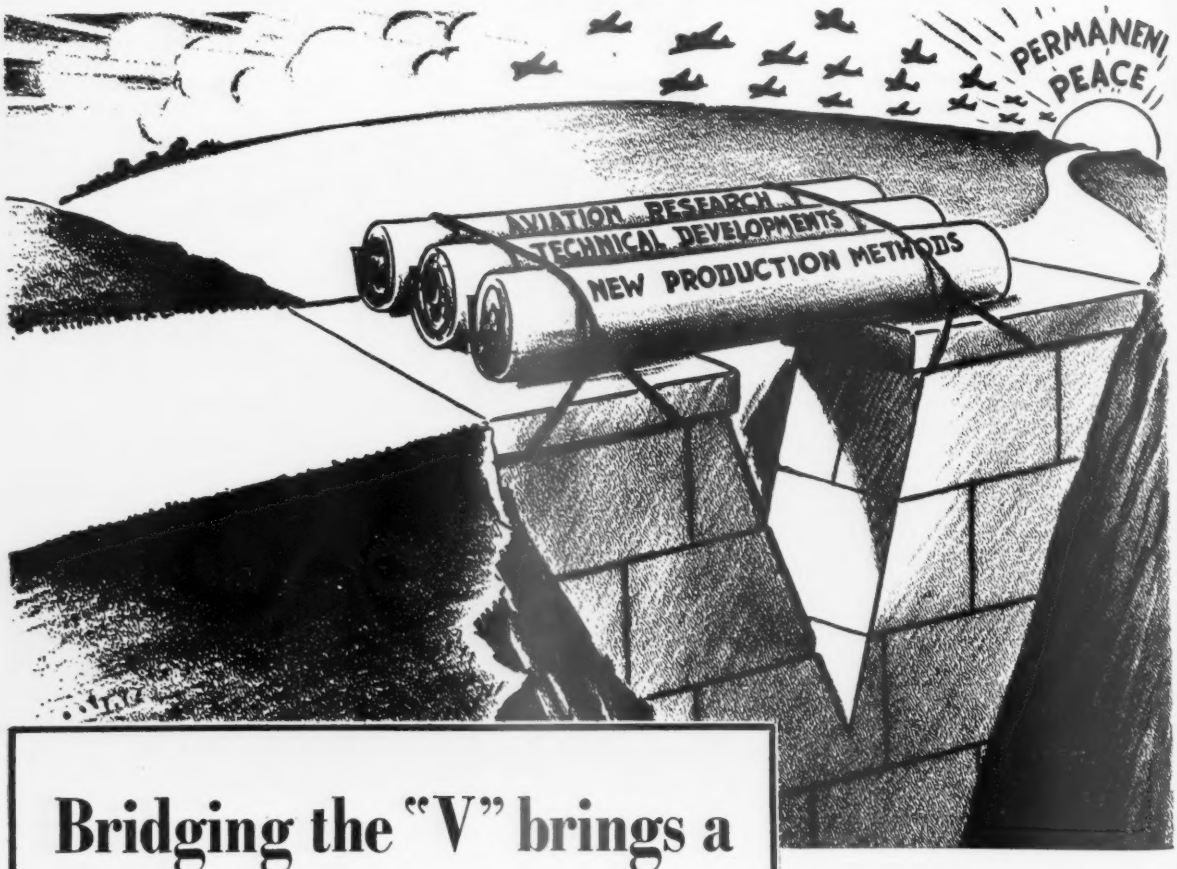

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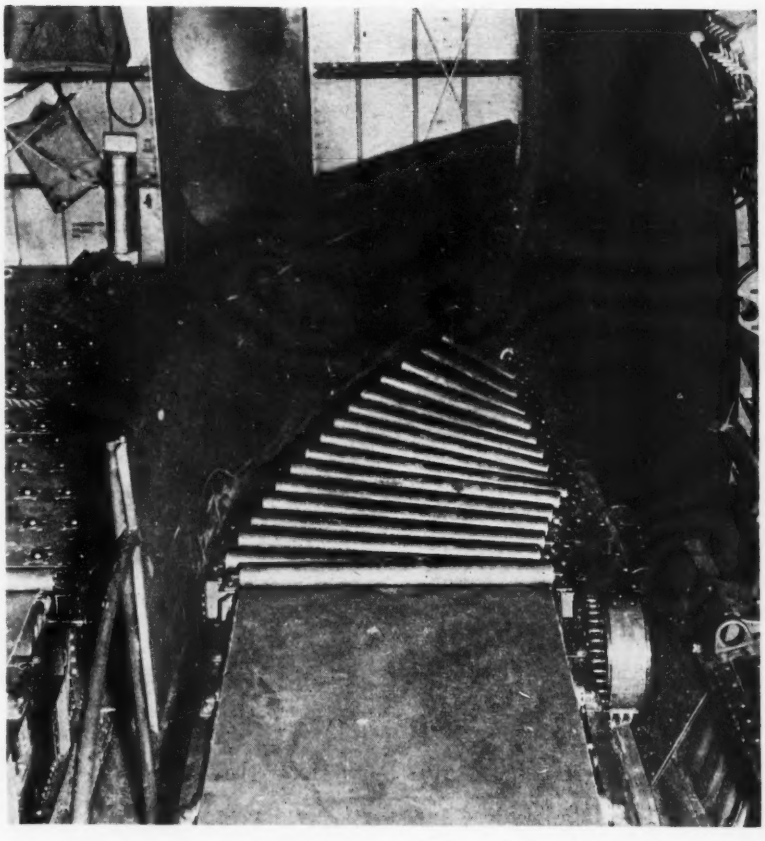
material itself, and tests of models built to scale are described. Another section of the paper refers to flight testing, describing the equipment employed and the results obtained. Discussions of the paper by various members of The Royal Aeronautical Society are summarized. *The Journal of The Royal Aeronautical Society*, September, 1945, pages 566–598, 25 illus.

Wing Testing. H. H. Gardner. Particulars are given about some of the more interesting developments in wing testing which have taken place in England during the war period. The method of testing the wing structures of large aircraft adopted by Vickers-Armstrongs, Ltd., is described. Details are given about early wing tests and about the wing-test bed developed later, showing how earlier difficulties were overcome. The equipment used and the results achieved are described with the aid of photographs and drawings. *The Journal of The Royal Aeronautical Society*, September, 1945, pages 599–610, 8 illus.

Superchargers

Intercooler Tube Design. Frederick H. Green and Leighton S. King. An account is given of research work conducted to develop an improved form of low-drag supercharger intercooler for high-altitude, high-speed airplanes. Results obtained with flattened and dimpled tubes are described. Particulars are given about tests that were performed to obtain information that would correlate these results with the usual methods of computing heat-transfer coefficients. *Automotive and Aviation Industries*, October 1, 1945, pages 40–42, 67, 68, 9 illus.



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The use of a conveyer belt system enables Combat Task Force C-37 crews to drop supplies to ground troops in advanced areas within a matter of seconds. The system, developed by engineers of the Personal Equipment Laboratory, Air Technical Service Command Headquarters, Wright Field, employs rollers and a guard rail to guide the cargos out the rear door of the plane. Static lines automatically open parachutes that are attached to the cargo containers.

Tools and Equipment

Reinforced-Concrete Assembly Fixtures. C. Monday. Details are supplied about a number of reinforced concrete assembly fixtures of unusually large dimensions employed by Short Brothers, Ltd., for the production of the Sunderland flying-boat hull. Reasons are given for the adoption of this type of construction—skilled labor for the erection of built-up steel structures was scarce and the design adopted made for speedy erection. Fixtures were required for the nose-to-center section of the aircraft, the center section unit, the aft section, and the tail unit. The general design and details were standardized as far as was possible. Illustrations show the fixtures in various stages of erection. *Aircraft Production*, October, 1945, pages 459–463, 10 illus.

Band Saw Developments for Industrial Shaping. H. J. Chamberland. An outline tracing wartime developments in band sawing which have resulted in the attainment of high cutting rates and improved finish. How the contour sawing of aircraft parts has been simplified and made more economical through improvements in the "Buttress" type saw is described. Information is given about a high-speed band saw adapted to general-purpose cutting produced by the DoAll Company. *Industrial Aviation*, October, 1945, pages 20, 22, 75, 76, 6 illus.

Evolution of a Cargo Stand. John A. O'Donnell. The cargo stand described is cited as an example of a design minimizing damage to the stand and the possibility of accidents. Developed by American Airlines' employees, it is a unit in which the weight of the upper section is balanced by a coil spring. The spring is said to have an unlimited life expectancy and the hinged section can be raised or lowered with fingertip pressure. *Air Transport*, October, 1945, pages 78, 83, 3 illus.

Centralized System. A brief description is given of equipment designed to facilitate the storage and distribution of lubricating and cutting fluids, as installed by the George D. Roper Corporation in a plant manufacturing large air-cooled aircraft engines. A battery of 36 Roper pumps in the oil-storage house of the plant is illustrated. *Automotive and Aviation Industries*, October 15, 1945, page 25, 1 illus.

Training

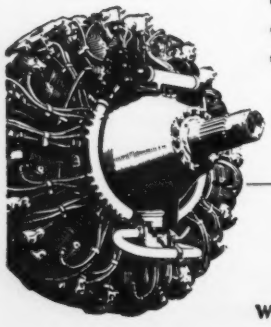
Learning to Fly. William D. Strohmeier. Information for the layman about the procedure of learning to fly is supplied in this article. The writer comments about the cost of instruction, the ways in which flying time can be bought, how to get the maximum efficiency from flying time, and other points of interest to the beginner. *National Aeronautics*, October, 1945, pages 11, 12, 60, 2 illus.

Aviation in the Schools. Edgar S. Fuller. Particulars are given about the aviation-education programs in some of the institutions of higher learning in the United States. The writer describes briefly the purpose of the programs, how they operate, and their results. It is pointed out that aviation has added a new dimension to the general training in elementary and secondary schools. *National Aeronautics*, October, 1945, pages 17, 18, 59, 1 illus.

Warfare

Grounding the Luftwaffe. L. Graham Davies. Based on a visit to Germany, the writer reports some im-

Cyclone 18 power, proved by ten million hours of operation for war, is now the first choice for flight on peacetime international trade routes. Eight airlines, operating in commercial competition between every major nation of all continents, have chosen to fly the Wright Cyclone-powered Lockheed Constellations. The power of the Cyclone 18 enables the Constellation to reduce transoceanic fares and yet cut costs, to increase speed and still carry greater payloads. This performance, linked with Cyclone reliability, made it aviation's first choice as war's end brings commercial engines back into production again.



WRIGHT Aircraft Engines

AIR POWER FOR A WORLD AT PEACE

Wright Aeronautical Corporation, Paterson, New Jersey, U.S.A. • A Division of Curtiss-Wright

pressions of the methods by which the German air force and aircraft industry are being disbanded. He indicates the status of the program, with particular reference to the British sphere of influence. In making his report, he gives details about German aircraft types and equipment. Data on the Rheinmetall-Borsig HL/131 V turret are featured. *The Aeroplane*, September 28, 1945, pages 354–356, 7 illus.; "After the 'Cease Fire'," by Major F. A. de V. Robertson, *Flight*, October 4, 1945, page 366.

Weight Engineering

Aeroplane Weight Analysis. W. I. M. Nightingale. It is noted that the general specifications of a new airplane invariably contain some weight figures but that few people realize the amount of work associated with the figures quoted. Possible methods of detailed weight analysis and center-of-gravity determination are indicated. An organization diagram of a weight section gives an idea of the scope of the work. Typical examples of weight-analysis sheets indicate methods of compiling data. *Aircraft Engineering*, September, 1945, pages 250–253, 3 illus.

Welding

Spot Welding of Heavy Aluminum Alloys. C. W. Dodge. The spot welding of heavy aluminum sheet for aircraft applications is discussed. It is noted that until recently the welding of heavy sheet, that is sheets with a thickness of from 0.102 in. to 0.187 in., has been considered difficult, but this was largely because of the limitations of welding equipment. Laws controlling the factors entering into the welding of heavy sheets of aluminum alloys, which were based on certain assumptions, are enumerated. Extensive tests conducted to determine whether the laws and assumptions were correct are described. The data were gathered from tests made on aluminum clad 24S-T sheet welded on electromagnetic stored-energy type equipment. *The Welding Journal*, October, 1945, pages 915–921, 6 illus.

The Welding of Non-Ferrous Metals. Part VII. E. G. West. In the seventh installment of this article the writer takes up the subject of welding aluminum and its alloys. The chief characteristics influencing welding ability are considered. Methods employed for making welds between aluminum and aluminum-alloy components are classified under seven heads. The first of these—hammer welding—is described in the current installment. *Sheet Metal Industries*, October, 1945, pages 1793–1796, 3 illus.

Resistance Welding. Part III. R. W. Ayers. The concluding section of a three-part article gives details about the seam-welding process and the machines employed in that type of work. Seam welders using two rollers or wheel electrodes are described as being made in three models: (1) longitudinal seam welders for work fed into the machine at throat depth; (2) circumferential or end seam welders for welding the ends of cylinders and drums and for straight runs where the depth of the arms is not an impediment; (3) universal seam welders for either of the foregoing purposes. The various types of wheel drives are outlined, as well as methods of controlling the interruption of the current flow, including the modulator, the thyratron, and ignition control.

After a brief reference to the mandrel type, the writer gives a description of series seam welding and mash welding, and concludes with remarks about methods of testing seam welds. *Aircraft Production*, October, 1945, pages 490–494, 13 illus.

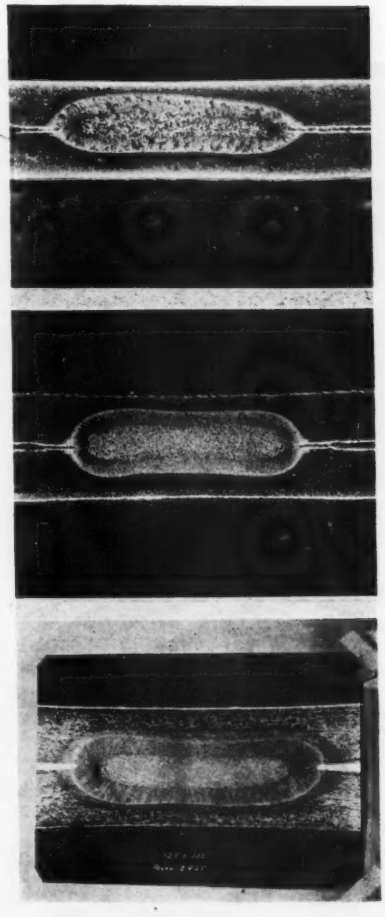


Illustration Courtesy Sciaky Bros.

In welding heavy aluminum sheets it was found that, where the magnitudes of all factors of the welding machine could be adjusted as desired, the size and shape of the optimum weld was similar regardless of thickness. The thicknesses of the sheets in the above illustration were 0.040 in. (*top*), 0.064 in. (*center*), and 0.125 in. (*bottom*).

Chemical Factors Affecting the Welding Properties of Stabilized 18-8 Stainless Steel. Franklin H. Page, Jr. A report is made of an investigation conducted by the Solar Aircraft Company to determine why some lots of stabilized stainless steel were more difficult to weld than others. The report has particular reference to the oxy-acetylene and atomic-hydrogen welding of 18-8 stainless steel in the manufacture of aircraft-engine exhaust manifolds.

Two hundred and eight heats of Type 321 titanium-stabilized stainless steel and 36 heats of Type 347 columbium-stabilized stainless steel were rated as to their relative weldability and these results were correlated against the chemical composition and other data. The results of the investigation indicate that the cost of welding stabilized stainless steels using oxyacetylene or atomic hydrogen may be materially decreased by slight changes in the chemical composition within existing specifications. *The Welding Journal*, October, 1945, pages 929–932.

Miscellaneous

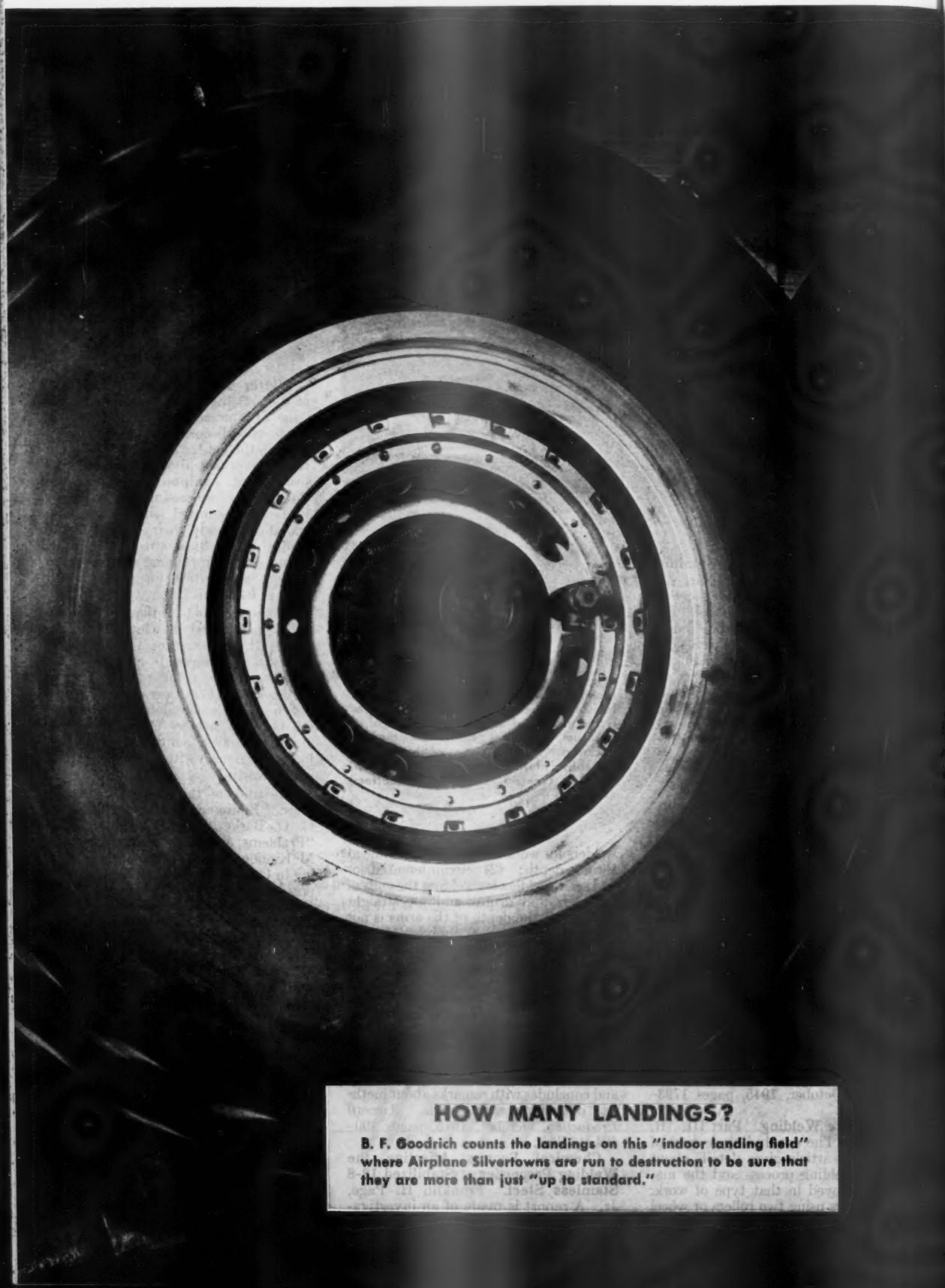
Winter Operations. The majority of the articles in the September, 1945, issue of *Commercial Aviation* are devoted to a discussion of winter operations in the field of aviation. Information is supplied about airplane accessories and equipment available in Canada for successful winter flying. Problems connected with cold-weather operations and their solutions are studied. Questions frequently asked about carburetor icing are answered. Airport preparation for winter conditions is described.

Financial aspects of the various problems encountered in winter flying are discussed. Information is supplied for potential commercial operators and owners regarding the way to prepare for cold-weather operations. Other articles include consideration of engine-oil dilution; heaters for medium-sized aircraft; and a summary of an airline's experiences with winter operations in the North.

The titles of the articles are as follows: "Equipment to Do the Job," by C. O. Barker, pages 22–26, 12 illus.; "Problems Aren't So Tough," by Leo McKinnon, pages 27, 28, 3 illus.; "Icing in Carburetor," pages 29, 30; "Airports When It Snows," by G. C. W. Dingwall, pages 31, 32, 3 illus.; "Costs: The Unknown Quantity," by C. H. Dickens, pages 34, 119, 1 illus.; "Tips Worth While," by Clare Leavens, pages 37, 68; "Oil Dilution: An Explanation," pages 38, 39, 1 illus.; "Heater in the Medium Field," pages 40, 41, 2 illus.; "Experience, It Counts," pages 42, 43, 2 illus. *Commercial Aviation*, September, 1945.

Directory of Western Aviation Suppliers. Companies engaged in supplying products or services to the Western aviation industry are listed. The directory was compiled from questionnaires mailed to the various firms. It lists sources of supply of aircraft parts, equipment, services, and maintenance, giving names, addresses, and products sold. *Western Flying*, October, 1945, pages 136–152.

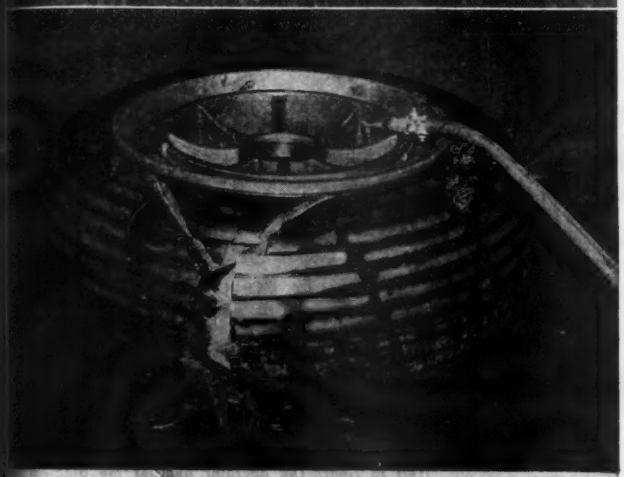
Torture chamber for tires means sa



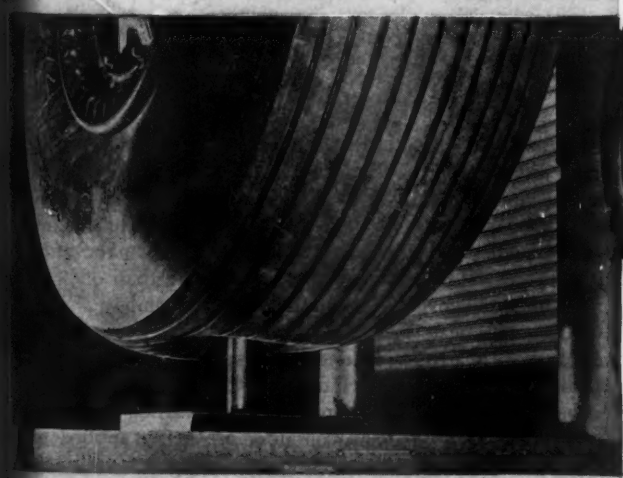
HOW MANY LANDINGS?

B. F. Goodrich counts the landings on this "indoor landing field" where Airplane Silvertowns are run to destruction to be sure that they are more than just "up to standard."

ansafer landings for planes . . .



BURST TEST! Water is forced into a B. F. Goodrich tire. The pressure mounts...up to many times that encountered in service. Finally (top picture), the tire bursts . . . is completely ruined as the second picture shows. Gauges record the story of a wide factor of safety.



WHAT ABOUT BRUISE RESISTANCE? Here's the test that finds out. The tire is forced down onto a steel rod under steadily increasing pressure. Down, down until something has to give. And the post-mortem leads to still further developments for greater tire safety.

B. F. Goodrich Silvertowns prove they can take it before they take off

LANDINGS are big moments in airplane tires' lives . . . moments when they have to take the shock of many tons multiplied by plenty m.p.h. If they're B. F. Goodrich Silvertowns, they're ready to take it . . . with lots to spare. Shown here are some of the reasons why.

B. F. Goodrich technicians "land" tires inside a building. They're smacked down with great force against a high-speed dynamometer and braked until the multi-ton flywheel comes to a stop. This "landing" is repeated time and again with careful wear and performance checks all the way.

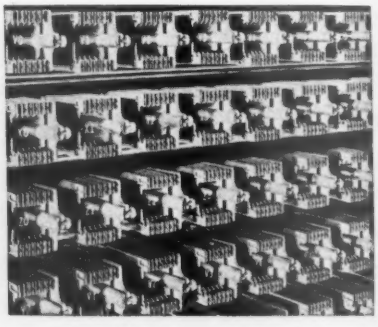
Then there are tests for bruise resistance, heat resistance, fatigue resistance, and others —altogether a "torture chamber" for tires. These are some of the ways B. F. Goodrich makes sure Airplane Silvertowns are kept up to *tomorrow's* standards—always ready for the new and heavier demands of larger and faster planes. *The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.*

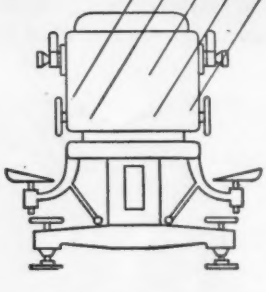
Skyway or Highway

B.F. Goodrich

FIRST IN RUBBER

Target practice with Relays and Keys





(Left to right) The operator punches the problem data on tape, which is fed into the computer. The solution emerges in the teletype receiver. Relays which figure out the problem look like your dial telephone system.

In designing the gun-control systems which shot down enemy planes, Army ballistic experts were faced by long hours of mathematical calculations.

So Bell Laboratories developed an electrical relay computer. It solved complicated problems more accurately and swiftly than 40 calculators working in shifts around the clock.

Resembling your dial telephone system, which seeks out and calls a telephone number, this brain-like machine selects and energizes electric circuits to correspond with the numbers fed in. Then it juggles the circuits through scores of combinations corresponding to the successive stages of long calculations. It will even solve triangles and consult mathematical tables. The operator hands it a series of problems with the tips of her fingers – next morning the correct answers are neatly typed. Ballistic experts used this calculator to compute the performance of experimental gun directors and thus to evaluate new designs.

In battle action, Electrical Gun Directors are, of course, instantaneous. Such a director helped to make the port of Antwerp available to our advancing troops by directing the guns which shot down more than 90% of the thousands of buzz bombs.

Every day, your Bell System telephone calls are speeded by calculators which use electric currents to do sums. Even now, lessons learned from the relay computer are being applied to the extension of dialing over toll lines.

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Government Publications

War Department

The United States Strategic Bombing Survey. Without qualification, this report is the most important evaluation of the resulting effects of air power yet written. It is one of the first, if not the first, surveys made by a civilian committee of the actual results of any service, military or naval.

The survey was made at the request of President Roosevelt, and the table of organization provided for 300 civilians, 350 officers, and 500 enlisted men. The civilian personnel consisted primarily of experts, analysts, technicians, and production men from a wide variety of occupations. The basic information was obtained from personal inspection of several hundred German plants, cities, and areas; from statistical data found in Government and industrial documents; and from interviews with thousands of Germans, including military and political leaders.

The Director of the Aircraft Division was Comdr. S. Paul Johnston, who reported to T. P. Wright, who was a member of the main committee.

The report is in three main divisions: military, economic, and civilian. The effects that strategic bombing had on each is clearly shown. The statistical analysis gives a broad summary of how bombing affected the Luftwaffe and German production of aircraft, antifriction bearings, gasoline and other oil products, synthetic rubber, chemicals, powder and explosives, steel products, and transportation.

The survey reaches the conclusion that Allied air power was decisive in the war in Western Europe. Its victory in the air was complete. At sea, its contribution, combined with naval power, brought an end to the enemy's greatest naval threat—the U-boat. On land, it helped to turn the tide overwhelmingly in favor of Allied ground forces. Its power and superiority made possible the success of the invasion. It brought German economy to a virtual state of collapse. Numerous charts and tables portray the facts and figures in vivid detail.

This survey will be followed by a similar report on the results of the use of air power in the Japanese War. A Summary Report on the European war has been issued as a separate document. It contains 18 pages of text matter summarizing the contents of the main report. *The United States Strategic Bombing Survey.*

Army Air Forces

Our Power to Destroy War. Gen. of the Army H. H. Arnold.* The Commanding General of the Army Air Forces outlines the strategy that brought about the defeat of Japan and emphasizes the steps that must be taken with the aid of air power to maintain world peace. He reviews the decisive part played by air power in the defeat of Japan in eliminating the necessity for an invasion of the home islands. With the aid of a map showing the comparative ranges of effective air offensive action from four typical bases, he sketches the types of military aircraft and armament of the future. In summarizing what is needed to maintain peace, he stresses the necessity for keeping an adequate force; a system of universal military training; and, most important of all, an ably staffed, adequately financed, and properly equipped research and development program. The article is supplemented by a chart of the suggested research and development organization. *Air Force*, October, 1945.

Details of German Aircraft. Information concerning German aircraft, engines, and air-ordnance development is reproduced in a group of 137 mimeographed sheets from data compiled by the British Air Ministry. It is made available by the War Department Bureau of Public Relations and the Public Relations Office of the Air Technical Service Command. The report is divided into six parts. The first deals with aircraft; the second, with power units; and the third, with aircraft guns. Part IV gives information concerning turbojet units, Part V describes power-boosting systems, and Part VI gives details about liquid rocket units. *Air Technical Service Command.*

Care of Personnel in the Wet Tropics. Advice is given with respect to the physical welfare of members of the Army Air Forces stationed in those parts of the world designated as the wet tropics. Precautions are offered with respect to acclimatization and the elements likely to affect men who are used to living in more temperate climates. Other sections deal with insects and disease, water and food, skin troubles, clothing to be used, and remedies for the bites of wild animals and snakes. *Informational Bulletin No. 9, Office of the Chief of Air Staff, Training Aids Division.*

The Airplane Commander is a pocket-sized booklet of 32 pages outlining the duties and responsibilities of the commanding officer of a military airplane. It contains suggestions for the commander with regard to relations with his crew, what he should know about the airplane and the duties of each crew member, and how to discharge his own duties. *Air Forces Manual No. 65*, February, 1945.

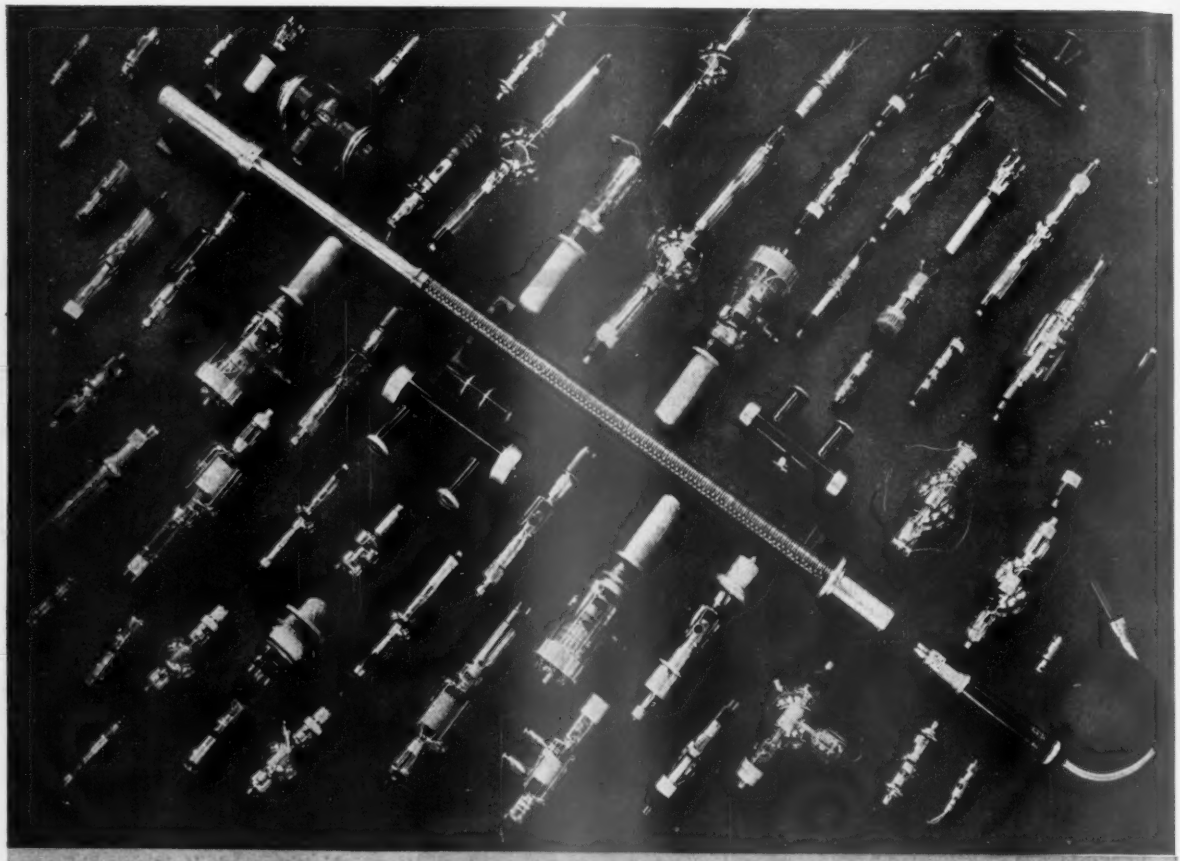
Overeating Causes Overloading. How airmen should govern their diet so as to avoid the disadvantages of overweight is given in pamphlet form. In addition to text matter giving advice about the proper quantities and types of food, there are tables showing the caloric values of various foods. Specimen diets are given. *Office of the Air Surgeon.* For sale by the Superintendent of Documents, Washington, D.C., $0.05.

Navy Department

Melting and Molding of Ferrous and Nonferrous Metals and Alloys: Foundry Manual. The Foundry Manual of the Bureau of Ships is intended for the use and guidance of Advanced Base and Repair Ship foundry personnel in casting the metals most commonly used by the Navy. It describes metals now in use at various naval yards, at the Naval Research Laboratory, and by industrial foundries for the production of steel, cast iron, bronze, brass, and aluminum-alloy castings. The information given is of such a general nature that it is applicable in principle to nearly all alloy castings.

The phases of foundry work dealt with are design, pattern making, sands, core making, molding, melting, pouring, heat-treatment, and cleaning. *U.S. Navy Bureau of Ships.* For sale by the Superintendent of Documents, Washington, D.C., $0.45.

Navy Training Courses. A series of books has been prepared for enlisted men of the Naval Aviation Branch designed to give them the information necessary to perform their aviation duties. Each book is given to a specific field of work in the operation and maintenance of naval aircraft. The books give detailed information concerning the particular work referred to, beginning with the fundamentals and progressing to studies of the theoretic and practical phases of the particular occupation to which the enlisted man is assigned. The titles of the books are as follows: *Aerology*, NAVPERS 10362,



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Air Coordinating Committee

The Air Coordinating Committee and What It Does. The Air Coordinating Committee was created by virtue of an Interdepartmental Memorandum dated March 27, 1945, signed by the secretaries of State, War, Navy, and Commerce Departments, in anticipation of the postwar expansion of civil aviation and to fill a long-recognized need for coordinated action by the agencies of the Federal Government which are charged with responsibilities in the aviation field. The A.C.C. is not an operating agency; it confines itself solely to matters of policy affecting aviation's transition from a war to a peacetime basis.

Its functions provide that it examine aviation problems and developments affecting more than one department or agency charged by the Congress with responsibility in this field and recommend integrated policy for action by the agencies represented on the Committee or by the President, subject to the provisions of the present or future applicable Federal statutes. This will serve to prevent duplication of activities and overlapping of functions. By confining itself solely to policy matters, it does not introduce another administrative layer in the handling by the Federal Government of aviation's activities and leaves each agency free to administer its activities as assigned by the Congress.

The Committee consists of William L. Clayton, Assistant Secretary of State, Chairman; Robert A. Lovett, Assistant Secretary of War for Air; John L. Sullivan, Assistant Secretary of the Navy for Air; William A. M. Burden, Assistant Secretary of Commerce; and L. Welch Pogue, Chairman, Civil Aeronautics Board. Mr. T. P. Wright, Administrator of Civil Aeronautics, is Executive Secretary.

The Interdepartmental Memorandum suggested several subjects for early consideration by the Committee. Among the problems now under consideration by the A.C.C. are: foreign air rights needed by United States flag aviation; relation of this Government with, and proposed programs for action by, the Provisional International Civil Aviation Organization; demobilization of the aircraft industry; postwar pilot training; postwar accessibility to the general public of technical data concerning wartime aviation experience; commercial possibilities of lighter-than-air craft; and postwar policy respecting air telecommunications affecting aviation.

Some of its conclusions and recommendations must at the present time be considered as "classified" and therefore not for public release. The Committee meets at biweekly intervals to consider problems screened and crystallized by its various subcommittees. The headquarters of the A.C.C. Secretariat is located in the Department of Commerce Building.

Army Service Forces

List of Signal Corps Personnel Being Released from Military Service. The headquarters of the Signal Corps Engineering Laboratories has released a list of occupations in which Army personnel have obtained skill and experience during the period of their service. Numbers of these men are currently being released, and the office of the headquarters is distributing these lists for the benefit of employers in need of such personnel, with the suggestion that employers anticipating vacancies list their requirements with the office so that service can be rendered both the employer and serviceman. If desired, arrangements can be made to send representatives to the Signal Corps Engineering Laboratories to conduct interviews there. *Headquarters Signal Corps Laboratories,* Bradley Beach, N.J.

Civil Aeronautics Administration

Survey of Air Operations. The conclusions reached by a group of C.A.A. officials, as a result of a trip made around the world by six officials as guests of the Army Air Transport Command, are summarized under 14 headings. The trip covered a route of 37,000 miles—42 localities. The principal conclusion reached by these officials is that the world-wide facilities installed and operated by the Air Transport Command can and should be used in peacetime air travel but that the high standards of safety established by the C.A.A. must be maintained. *Office of Aviation Information.*

The Aircraft Pilot: 5 Years of Research, A Summary of Outcomes. Morris S. Viteles. The Chairman of the Committee on Selection and Training of Aircraft Pilots of the National Research Council has prepared a report giving an overall review of the research program for the five-year period from 1940 to 1944, inclusive. The report is designed to help in evaluating (1) the effectiveness with which the research program has been conducted; (2) contributions that it has made to the progress of aviation; (3) the respects in which anticipated outcomes have not been achieved. It is noted that a large portion of the activities of the committee has been given to work in connection with the war during the major part of the period encompassed by the report, but it is also shown that a large portion of this work will be applicable to civilian aviation in the postwar period. The report is written chiefly for the purpose of focusing attention on the useful results of research. In this connection it is pointed out that in some instances the outcomes were in the form of negative findings, which perhaps helped to avoid the imposition upon the military services and upon the C.A.A. of costly and cumbersome procedures that would drain available resources without adequate return.

The principal sections of the report deal with pilot selection and classification; pilot training; evaluation of pilot performance; emotional disturbances associated with learning to fly; studies of air sickness; aviation accidents; and general customs. An appendix lists the cooperating research centers and project directors. *Division of Research Report No. 46.*

History and Development of the Ohio State Flight Inventory. Part I: Early Versions and Basic Research. Harold A. Edgerton and Robert Y. Walker. A mimeographed pamphlet of 57 pages contains the first part of a report of studies conducted at the Ohio State University by grants-in-aid from the National Research Council Committee on Selection and Training of Aircraft Pilots, from funds provided by the C.A.A. It describes the early research that led to the formulation and preparation of a comprehensive and standardized check list of items descriptive of a pilot's performance during flight. This check list, when used in conjunction with standard flights, has provided a valuable source of criterion data in aviation research.

Check sheets are available for each maneuver taught in the C.A.A. elementary course. Items are grouped, wherever possible, according to the operation of the maneuver being observed—for example, entry, turn, and recovery in turns. When used in conjunction with standard flights, the inventory provides for standardized observation and recording of the details of pilot performance during each maneuver.

The present report constitutes Part I of the complete report of the Ohio State Flight Inventory and describes early versions and basic research upon which the later versions were developed. Part II, to be issued separately, will describe intermediate forms of the current versions of the inventory and the outcomes from the use of the inventory in Committee research projects. *Division of Research, Report No. 47,* July, 1945.

Civil Aviation and the National Economy is a 159-page report of a comprehensive study of the industry's possibilities during the next 10 years.

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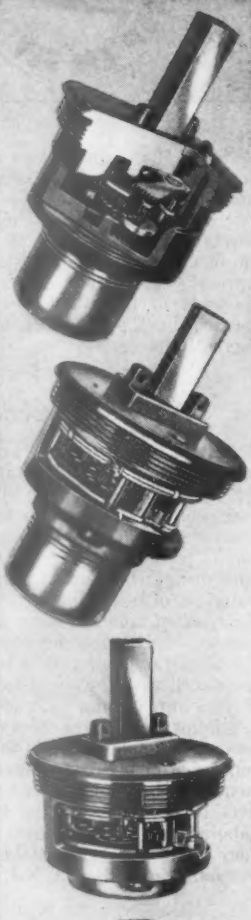

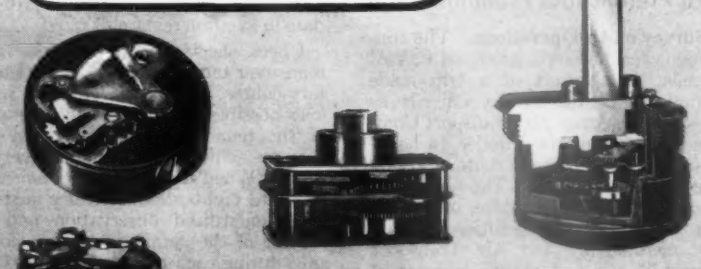

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It predicts that civil aviation by 1955 will be able to provide more than 750,000 new jobs. It forecasts "a 30 per cent annual increase in aircraft as they acquire greater utility and more airports are provided," with the result that "there will be more than 400,000 civil airplanes in use in the United States by 1955."

Of the 400,000 aircraft, the study says, 280,000 will be used for personal business and recreation; 40,000, by business concerns to speed up their sales and administration activities; and 80,000, by commercial aircraft services in crop-dusting, aerial photography and other nonscheduled operations. In addition, the report predicts that air lines will carry 20,000,000 passengers in domestic operations during 1955 and 2,000,000 passengers to foreign points.

Attainment of these goals, the book states, is dependent on a Federal program of assistance to civil aviation, essentials of which are a national airport plan, pilot training and aviation education, and technical aids such as an improved airways system. The study warns that a positive program is needed to take advantage of the present "ideal combination of circumstances for aviation growth." It points out that "the end of the war has released aviation facilities which will go to seed unless immediate concrete steps are worked out."

A total of 901,300 jobs in, or created by, aviation is predicted for 1955 as compared with 142,300 in 1939. While jobs in civil aviation will be "but a small proportion of the total number of jobs envisioned in the postwar economy, yet in terms of new jobs created, the industry will rank high. This one business can provide almost 6 per cent of all the new jobs required to achieve substantially full employment."

The book describes the prewar civil-aviation industry and its wartime changes, reviews past Federal aid, estimates the 1955 growth potential of all branches, and outlines a Government program of assistance. It contains appendixes giving detailed studies of the 1955 aviation employment outlook and the 1955 market for personal aircraft, in addition to statistical reference tables. *Office of Aviation Information.* For sale by the Superintendent of Documents, Washington, D.C., $0.55.

Expansion of World Airlines to Require 16 CAA Foreign Offices. Anticipating that 200 United States air liners will be operating over 170,000 miles of world airways within 2 years, the Civil Aeronautics Administration is planning to increase immediately its foreign offices from the present three to six and then to a total of 16 in 1946. The new offices for the current year will be in Stockholm, Lisbon, and San Juan, Puerto Rico. C.A.A. offices are already operating at Rio de Janeiro, Brazil; Lima, Peru; and the Panama Canal Zone.

Each office will be staffed with a minimum of four experienced C.A.A. employees. Three technical men—one each for air-carrier operations, maintenance, and radio—and a clerk will be

transferred from domestic operations to ensure the best of service.

Beginning in July, 1946, the C.A.A. hopes to extend its foreign field coverage of operations by opening offices in Cairo, Karachi, Manila, Hawaii, Paris, Buenos Aires, Natal, Tokyo, Santiago, and Noumea, New Caledonia.

The foreign offices of C.A.A. are being planned to implement safety measures for the great increase in intercontinental traffic, which has already surpassed the prewar peak. Before the war, fewer than a dozen planes were crossing the oceans on biweekly schedules; now schedules are proposed with an immediate increase of at least 30 planes to operate on a daily basis. Previous route mileage was approximately 44,000; now the lines are approved by the Civil Aeronautics Board for more than 100,000 air miles. *Office of Aviation Information.*

Civil Aeronautics Board

Economic Decisions of the Civil Aeronautics Board, Volume III, covers the period August, 1941, to December, 1942. It contains a list of reports and decisions rendered by the Board, with tables of cases reported and cited and an index digest. For sale by the Superintendent of Documents, Washington, D.C., $1.75.

Uniform System of Accounts for International Air Carriers. Revised pages are supplied for addition to the Uniform System of Accounts for International Air Carriers, the current addition constituting Amendment No. 4 thereto. Among the changes, the system of numbering amendments to the manual has been changed to conform to the amendment numbers in orders of the C.A.B.

Amendments Nos. 1–3, inclusive, can be disregarded, since all presently effective revisions applicable to the manual are included in Amendment No. 4. *C.A.B. Form 2380, Manual 1-1-43.*

Civil Air Patrol

Civil Air Patrol History, Organization, and Purpose. In the form of a 7-page pamphlet, an outline is given of the organization and activities of the Civil Air Patrol. The first section traces the founding of the unit, with a brief outline of the qualifications for membership. Other sections give specific information about the activities of the organization in training, on military missions, on civilian defense missions, and as an aerial home guard. Further sections give details about the ground services rendered by the organization, the recruiting and cadet training, the support given to civilian aviation, and the public relations of the Patrol. *Civil Air Patrol Training Manual No. 6,* October, 1945.

Department of Agriculture

DDT Applied Against Certain Forest Insects in 1944, Particularly with Aerial Equipment. Phillip G. Dowden. In mimeographed form a report is given concerning the work of the Bureau of Entomology and Plant Quarantine in testing the effectiveness of certain insecticides against various insects. One of the important means of applying these insecticides was by spraying from aircraft. The report gives details of its applications through the use of a small light airplane of the private-aircraft type. *Agricultural Research Administration, Bureau of Entomology and Plant Quarantine,* June, 1945.

Department of Commerce

Index of Available Industrial and Scientific Technical Reports. The first index on industrial and scientific technical reports has been released by the Army and Navy to the Office of the Publication Board of the Department of Commerce for dissemination. This is the first group of combined Intelligence Objectives Committee reports that have been declassified for distribution to industry.

Many of these reports are only an evaluation of plants investigated or interviews held with German scientists; they contain little technical information concerning the processes used.

Copies of the original reports as listed in the index are now available for examination in the auditorium of the Department of Commerce building in Washington, or copies may be obtained by mailing checks or money orders, drawn to the Secretary of Commerce, at the prices listed in the index. *Office of the Publication Board,* Washington, D.C.

Western Hemlock Plywood. A 14-page pamphlet offers standard grading rules affecting four grades of moisture-resisting types of Western hemlock plywood. In addition, information is given about tests, standard sizes, size tolerances, reinspection rules, and nomenclature and definitions. A list of the firms that have accepted these grading rules for use in the production, distribution, testing, and use of Western hemlock products is included. *Commercial Standard CS122-45, National Bureau of Standards.* For sale by the Superintendent of Documents, Washington, D.C., $0.05.

National Airport Plan. In the form of a letter from the Acting Secretary of Commerce, House Document No. 807 of the 78th Congress, Second Session, transmits a report of a survey of the need of a system of airports and landing areas throughout the United States. The principal sections of the report deal with the need for more airports; deficiencies in the present system; what is required; estimates of cost; clearing and protecting airport approaches; and airports as Federal public works. An appendix reviews previous C.A.A. service and construction. Numerous tables are included listing existing and proposed airports by states. *Office of Acting Secretary of Commerce.* For sale by the Superintendent of Documents, Washington, D.C., $0.20.

National Advisory Committee for Aeronautics

Stresses at Cut-Outs in Shear Resistant Webs as Determined by the Photoelastic Method. Benjamin F. Ruffner and Calvin L. Schmidt. The purpose of this investigation was to determine the most efficient shape of cutout and to determine the maximum stress concentration factors induced by various cutouts. The photoelastic method was used for the investigation because the region of maximum stress and the amount of maximum stress are readily determinable by this method. Values for stress concentration factors determined by this method are, however, applicable only in the elastic range.

Stress concentration factors for shear stresses around cutouts in the webs of beams having shear resistant webs were determined by the photoelastic method. Webs with circular, square, and rectangular cutouts were tested. The effect of reinforcements around square and circular cutouts was investigated. Results indicate that square and rectangular cutouts having two sides parallel to the neutral axis of the beam should be avoided whenever possible. Circular cutouts and square cutouts, with sides at 45° to the neutral axis, produced lower stress concentration factors than the other two types. *Technical Note No. 984,* October, 1945.

Effect of Fatigue-Stressing Short of Failure on Some Typical Aircraft Metals. J. A. Bennett. A number of tests were made to determine the effect of service stresses on the impact resistance, the X-ray diffraction patterns, and the microstructure of 25S aluminum alloy. The average impact resistance was found to be unimpaired even in material cut from specimens previously broken by repeated stress. The X-ray diffraction patterns showed no structural change resulting from the fatigue-stressing of the alloy. Two structural conditions known as slip-plane precipitation and veining were observed. "Veining" in the structure could be made to disappear and reappear by alternate solution heat-treatment and age-hardening. It was concluded that the fatigue-stressing was not responsible for these structural features and the endurance limit was not reduced by it.

In attempts to detect and evaluate damage resulting from fatigue-stressing prior to the start of cracks, the impact behavior of normalized SAE X4130 steel was determined after a variety of repeated stress treatments. The results are valuable in showing the effect of fatigue cracks on impact resistance, but they do not give any indication of damage occurring before the cracks had formed.

Damage of this kind was evaluated by determining the decrease in endurance due to stressing above the fatigue limit. In a large proportion of the tests made, a deflection method was used to detect crack formation so that the damage measurement could be definitely limited

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to the precrack stage. The results showed that the apparent rate of damage depends on the stress history. If the prestress is higher than the test stress the damage occurs rapidly at first, then more slowly. The reverse is true if the damage is inflicted at a stress lower than that used to measure it. *Technical Note No. 992*, October, 1945.

National Bureau of Standards

Table of Coefficients for Numerical Integration without Differences. Arnold N. Lowan and Herbert E. Salzer. Tables are given to show the value of certain polynomials up to ten decimals for specified values. For certain values the polynomials are tabulated at intervals of 0.01, and for other values they are tabulated at intervals of 0.1. The tables are given for three-point, four-point, five-point, six-point, and seven-point coefficients. Reprinted from the *Journal of Mathematics and Physics*, February, 1945, by the National Bureau of Standards.

Office of War Mobilization and Reconversion

Three Keys to Reconversion; Fourth Report. The fourth report of the Director of War Mobilization and Reconversion to the President, Senate, and House of Representatives reviews the problems involved in the sudden ending of the war and the progress made toward reconversion in the period covered.

The present report deals with the pressing problems and the immediate policies of the transition period of the nation's economy. Its principal sections refer to the matter of expanding production; the special problems involved in the disposal of surpluses; housing and construction; food and agriculture; transportation; overseas problems; demobilization and veteran's rights; release of scientific information. The operations of the Advisory Board are reviewed. Charts show the progress made in reconversion, the trend of war production, a comparison with conditions in 1918, unemployment compensation, and releases from the armed services. October 1, 1945.

Smaller War Plants Corporation

Report to Congress from Smaller War Plants Corporation. The nineteenth bimonthly report to Congress of the Smaller War Plants Corporation refers to the period of June and July, 1945. It shows a drop of 40 per cent in the war contracts placed with small plants, by comparison with the previous two months, emphasizing the necessity for making materials available to facilitate the reconversion of those plants to civilian production. Emphasis is given to the activities of the 114 regional and district offices of the Corporation with regard to the problems of small business organizations all over the country.

Other sections of the report deal with surplus property, opportunities of small business to help war veterans, and the relationship of small business to monopoly and the concentration of resources. The tables give a statistical summary of procurement contracts during the period of the report. *Smaller War Plants Corporation.*

U.S. Patent Office

Register of Patents Available for Licensing or Sale. From a periodical list of patents made available for licensing or sale, there are several that are applicable to the aeronautical sciences. One of these is a high-speed strain gage; another is a device for measuring extremely small angles; and a third is a wind calculator. Another list includes a group of three patents consisting of a generator-regulating system, a current-regulating system, and a generator regulator, while another item refers to a piston and piston-rod assembly for a hydraulic wing-flap cylinder. *United States Patent Office Official Gazette*, September 25 and October 2, 1945.

War Department

Aircraft Electrical Systems. Revised technical manual TM1-406 supersedes a manual of similar number dated April 16, 1942. It is intended as a source of general information regarding the principles of operation and maintenance of electrical equipment used in aircraft. Specific information and the most recently authorized maintenance procedures for each type of equipment are given in the War Department's Technical Orders, which is being followed in all cases, but the manual offers general guidance.

The first seven sections give fundamental information about electric power and direct and alternating current, and the remaining sections deal with specific applications of electric power to aircraft and the different systems in which electric power is used, such as the storage batteries, generators and regulators, ignition systems, auxiliary motor systems, starting systems, lighting, wiring, and auxiliary systems. *War Department Technical Manual TM1-406*, February, 1945. For sale by the Superintendent of Documents, Washington, D.C., $0.45.

Aircraft Fabric Work and Application of Finishes. The purpose of this manual is to provide in condensed form the technical information necessary for training personnel in inspection and maintenance of "dope" and fabric-shop equipment, the fabrication and repair of airplane and glider fabric coverings, and the application of protective and camouflage finishes to fabric and metal surfaces. The material included is based on Army-Navy specifications, Army Air Forces Technical Orders, A.A.F. Regulations, Stock Lists, and other authorized sources. It is intended for use as a general reference and is not to be regarded as replacing technical orders and regulations.

The first four sections of the manual describe the textiles required and the methods of applying these to structural surfaces. The remaining sections include instructions on paint-shop equipment, finishing procedures, aircraft-identification markings, and methods of repairing "doped" fabric surfaces on airplanes and gliders. *War Department Technical Manual TM1-417*, September, 1945. For sale by the Superintendent of Documents, Washington, D.C., $0.20.

War Manpower Commission

Apprentice Training for Returning Servicemen. Information is given in a 12-page pamphlet concerning the facilities made available by the Government under the educational and training benefits established in the "GI Bill of Rights" and similar legislation. It describes the types of training offered and outlines the advantages of such training in getting service personnel back into industry.

Included in the information is an explanation of the financial benefits of the veteran's legislation, which is supplemented by data about the apprentice wages, qualifications required for veterans for these benefits, as well as apprentice training, procedure to follow, application forms, and experience records needed. Among the other data is a list of over 100 skilled trades in which workers are trained through apprenticeship and ten major points that identify a bona fide apprenticeship program. *Bureau of Training, Apprentice Training Service*, Washington, D.C.

Lists of Professions and Skilled Positions. Lists are available in the form of file cards of uniform size setting forth requirements, duties, and other data of interest in personnel work, with regard to a wide variety of positions in professional and skilled factory work. Among the professional positions are aeronautical engineering, metallurgy and metallurgical engineering, and mechanical engineering. The cards are prepared in uniform style, with headings appropriate to the particular profession, giving the available fields of work, the educational qualifications, and the sources of employment.

Another group of cards, prepared in a somewhat different manner, gives information in uniform style about a variety of factory jobs requiring certain skills. Those connected with the aeronautical industries include the following: toolmaker; layout man; sheet metalworker; spinner; landing-gear assembler; patternmaker; pipe fitter; glazier; Plexiglas former; instrument man. *National Roster of Scientific and Specialized Personnel* (for the professional positions) and *Bureau of Utilization* (for the skilled factory jobs). For sale by the Superintendent of Documents, Washington, D.C., $0.05 each.

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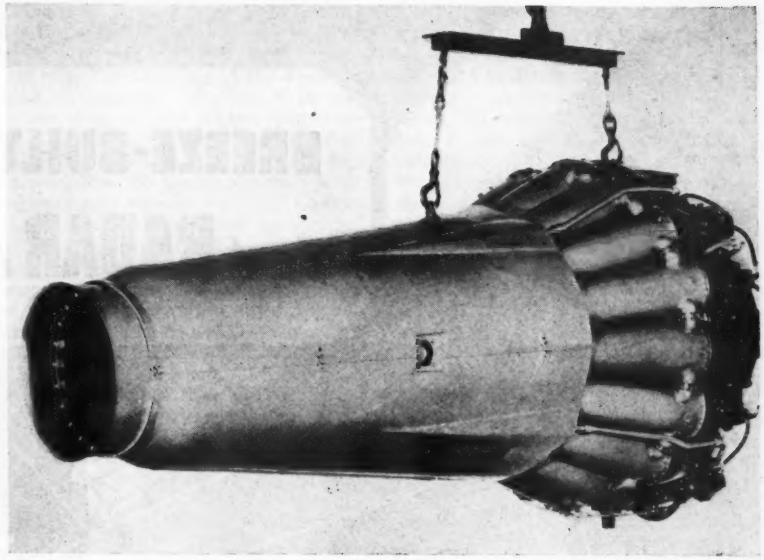
British Information Services

Aerodynamic Aspects of Blind Flight. A. V. Stephens. It was required to determine whether blind-flying technique could be improved by limiting the operations of the pilot and relying to a great extent upon the stability of the aircraft. Flight tests were made at two speeds on a Blenheim, for center of gravity positions covering the available range, to determine its behavior in bumpy air with elevators locked and rudder free. The effect of lowering the undercarriage was noted. Turns of various rates with elevators locked for trim were also investigated. Blind flying under a hood with elevators locked and/or rudder free was carried out for comparison with normal technique. The results of the experiments are discussed, and a general survey of aerodynamic requirements for blind flight is given.

The tests showed that, if carefully trimmed, the Blenheim would fly continuously through severe bumps with elevators locked without appreciable loss of height or change of speed. It was, however, essential to maintain full control of the ailerons in bumps or a spiral would develop, causing rapid loss of height and change of course. Turns with elevators locked were unsatisfactory in that height was lost and speed gained. The behavior of the aircraft in straight flight with elevators locked was not greatly affected by changes in the center of gravity position within the allowable range. Turns were less unsatisfactory with the center of gravity aft.

After short periods of blind flight under the hood, pilots were of the opinion that locking the elevators did not make control easier on a stable aircraft such as the Blenheim. They were also of the opinion that this device would be of limited use in service and likely to be a fruitful source of accidents.

More generally, it was concluded (1) that for ease of control in cloud, longitudinal stability with control column both fixed and free was essential. The dynamic stability of the Blenheim was considered adequate in that the aircraft would ride through bumpy air with little or no deliberate use of the elevators. More static stability would, however, be advantageous. (2) The ability to make accurate turns and corrections to course without using the rudder was highly desirable. Equally good results might be obtained if full control could be maintained without using the ailerons. (3) Controls should be light, effective, and free from friction. (4) It would be more difficult to maintain constant speed on a clean aircraft at economical cruising speed but not at top speed. (5) Spiral stability was not in itself important, but the aircraft should be designed as far as possible to maintain an even keel in bumps. It is not yet known how this can be best achieved. *Ministry of Aircraft Production, Aeronautical Research Committee R. & M. No. 1940.* British Information Services, New York, $0.90.



Photograph Courtesy British Information Services

The de Havilland Goblin turbojet engine. This engine has a straight-through gas flow and a single-side centrifugal compressor. It is stated that it has run 500 hours under official-type test conditions without change of any main component.

Note on the Effect of Nose Shape on the Characteristics of Frise Ailerons. H. Davies and E. C. Brown. Wind-tunnel tests have shown that a sharp-nosed Frise aileron on a wing with N.A.C.A. 4415 tip section stalled completely at angles of about 13° (up going). A sufficient rounding of the nose of the aileron removed this stall; at the same time the balance was reduced slightly, and the range over which constant balance could be obtained was increased by about 4°. The reduction in balance produced by cords near the trailing edge has been investigated, and tests have also been made on the effect of hinge height. The results of the tests are given in tables. Hinge moments are given for one aileron alone, as well as for two ailerons without differential. The application to full scale of model tests on the balance of Frise ailerons is somewhat uncertain, but it is considered that the conclusions reached on the relative effect of the modifications made are reliable. *Ministry of Aircraft Production, Aeronautical Research Committee R. & M. No. 1941.* British Information Services, New York, $0.75.

Derivative Measurements and Flutter Tests on a Model Tapered Wing. W. P. Jones and N. C. Lambourne. The influence of various parameters, such as wing density and flexural stiffness, on the critical speed of a tapered wing was investigated theoretically in *R. & M. 1782*, using certain fundamental aerodynamic derivative coefficients. The principal object of the present wind-tunnel tests was to provide an experimental confirmation of the theory. A semirigid model wing of the R. & M. 1782 type was constructed with two tapered wooden spars of cruciform cross section. Its flexural axis lay at 0.3 chord and its inertia axis at 0.4 chord behind the leading edge.

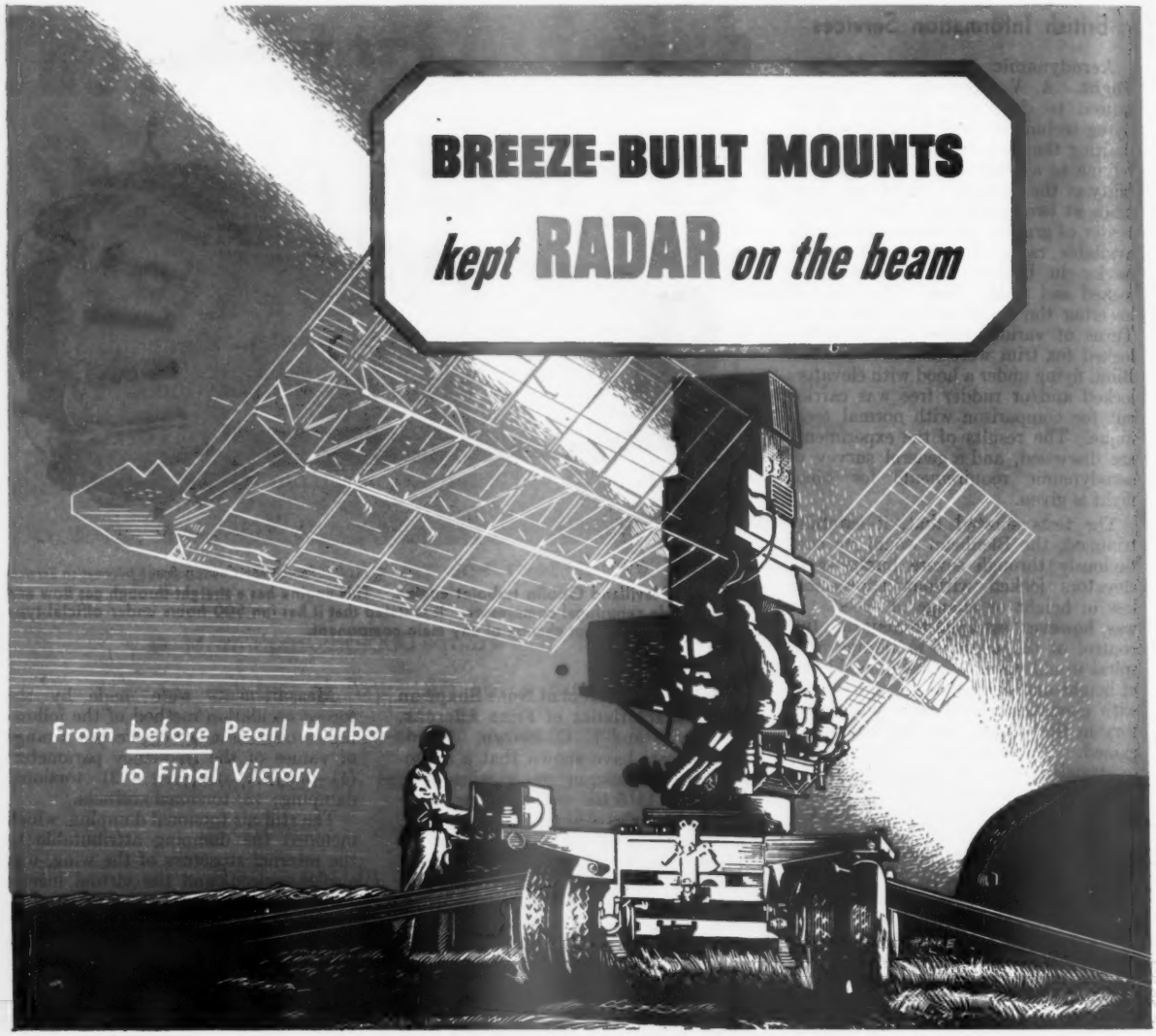
Measurements were made by the forced oscillation method of the following aerodynamic derivatives for a range of values of the frequency parameter: (1) flexural damping; (2) torsional damping; (3) torsional stiffness.

The still-air torsional damping, which included the damping attributable to the internal structure of the wing, was also measured, and the virtual inertia effects due to the external air were estimated by two-dimensional strip theory as described in *R. & M. 1946*, "The Virtual Inertias of a Tapered Wing in Still Air."

The experimental results indicate that the direct flexural and torsional dampings can be estimated with fair accuracy from the fundamental derivative values given in *R. & M. 1782*, but the static and dynamic torsional stiffness derivatives are given more accurately by strip theory as in *R. & M. 1964* "Flexure-Torsion Flutter Derivatives for Semi-Rigid Wings."

The estimated critical speeds obtained by using the experimentally determined inertias and the derivative values of R. & M. 1782 are too high and the corresponding frequency parameters too low; better agreement is obtained by using the measured instead of the estimated value. The predicted speeds obtained by using the true inertia constants instead of the inertia values given by resonance experiments in air are much too high. It appears therefore that the experimentally determined inertial coefficients must be used with the derivatives of R. & M. 1782 to predict critical speeds with any accuracy. *Ministry of Aircraft Production, Aeronautical Research Committee R. & M. No. 1945.* British Information Services, New York, $0.90.

Aerodynamic Forces on an Oscillating Aerofoil-Aileron-Tab Combina-



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tion. W. Prichard Jones. As a preliminary to the investigation of the flutter characteristics of a wing with aileron and tab suggested by the Oscillation Sub-Committee, the two-dimensional air-load coefficients and an airfoil-aileron-tab system with four degrees of freedom have been derived by the use of certain well-known results in vortex sheet theory. The formulas for the aerodynamic forces on an airfoil-aileron combination as given by Theodore Theodorsen are equivalent to those deduced by the method of this paper when the terms introduced by the angular motion of the tab are omitted. Furthermore, for nonoscillatory motion, the formulas given in this note lead to the same values of the air-load coefficients as those obtained by W. G. A. Perring.

In the analysis, the system is assumed to be describing simple harmonic oscillations of small amplitude which define the translational motion and the angular motions of the airfoil, aileron, and tab. The chords of the airfoil, aileron, and tab are denoted, and both aileron and tab are assumed to be hinged at their respective leading edges. The origin of coordinates is, as usual, taken to be at the airfoil mid-chord position, and the abscissa is measured positively rearwards and is expressed for convenience in terms of the angular coordinate. The values correspond, respectively, to the positions of the aileron and tab hinges. Certain functions that are involved in the analysis are tabulated for various values of the aileron-airfoil chord ratio and the tab-aileron chord ratio. *Ministry of Aircraft Production, Aeronautical Research Committee R. & M. 1948.* British Information Services, New York, $0.90.

Some Experiments on the Elastic Deformation of Thin-Walled Tubes in Torsion. C. Gurney. Six steel tubes of doubly symmetric cross sections were subjected to self-equilibrating end torques, an attempt being made to avoid axial constraint at the loading sections. Distortion measurements were made on the outsides of the tubes and were confined to positions on the axes of symmetry of a cross section. The following measurements are recorded: (1) twist; (2) axial distortion; (3) rotation of generators; (4) bending of walls.

The twist was measured at a position near the mid-length of each tube on a gage length of about 3 in. Measurements two, three, and four were confined to stations at the mid-length of the tubes. The experimental results were compared with the series solution of Duncan. The first term of this solution is attributed to Bredt and is referred to, in this paper, as the "Bredt formula." The sum of the first two terms is here referred to as "Duncan's second approximation."

When allowance is made for experimental inaccuracies, the experiments show that the stiffness of the tubes is in fair agreement with theory, the tendency being for the experimental stiffness to be rather higher than the theoretic. The axial distortions were less than the theoretic (as calculated from the Bredt formula) at the ends of the long diameter of a cross section and more than the theoretic at the ends of the short diameter. This was to be expected, since it was known that the Bredt formula gives too low a value for both stiffness and shear stress at the outer surface at the positions where measurements were made. The experimental results are in better agreement with the theory attributed to Duncan. The indications are that Duncan's second approximation is satisfactory for engineering purposes for tubes of ratio of thickness to smallest diameter not exceeding one-quarter. *Ministry of Aircraft Production, Aeronautical Research Committee R. & M. No. 1955.* British Information Services, New York, $0.75.

Calculation of the Damping of the Lateral Oscillation of an Aeroplane. L. W. Bryant and M. L. Hopwood. An approximate formula for estimating the damping factor, the real part of the complex roots of the lateral stability equation, is given. Inertia values typical of single-, two-, and four-engined aircraft are assumed, and tables of computed values of the total damping and of the component terms in the approximate formula are included for various values of the chief parameters. The prototype lateral oscillation without yawing components, first described by Lanchester, is always lightly damped and soon becomes unstable as rolling inertia is increased, unless the values of certain parameters are all small. Increase of fin surface improves the damping of the lateral oscillation. The analysis shows that the damping factor multiplied by a given factor can be considered as the sum of four given quantities.

A table is given as typical of the mean conclusions derived from the analysis. *Ministry of Aircraft Production, Aeronautical Research Committee R. &. M. No. 1956.* British Information Services, New York, $0.75.

Harmonic Gas Torques in Petrol Engines: Analysis of Recent Indicator Diagrams. W. J. Evans. At the request of the Oscillations Sub-Committee of the Aeronautical Research Committee, a study has been made of harmonic gas torques in gasoline internal-combustion engines for aircraft. The results are tabulated and plotted, some of this work having been done by outside investigators.

The investigation reveals that the values of the resultant harmonic torque coefficient, as derived from hypothetic or theoretic indicator diagrams, underestimate those obtained from observed indicator diagrams. It is suggested that designers and calculators who are attempting to predict the relative severities of the critical factors that may occur in the normal operating range for any particular new design of engine should use mean values quoted in one of the tables for the resultant harmonic torques and the appropriate values given in another table for the component coefficients, allowance being made for the indicated mean effective pressure. The writer recommends that a reliable indicator be used to take diagrams under different conditions of engine operation to determine the effects of the harmonic coefficients of (a) engine speed, (b) supercharger-pressure variation, (c) ignition timing, and (d) mixture strengths. *Ministry of Aircraft Production, Aeronautical Research Committee R. & M. No. 1964.* British Information Services, New York, $0.60.

The Initial Buckling of Flat Rectangular Panels under Combined Shear and Compression. H. G. Hopkins and B. V. S. C. Rao. This report investigates theoretically the initial buckling of a flat rectangular panel with simply supported edges under combined shear and compression. The applied shear is constant round the panel, while the applied compression is uniformly distributed along, and at right angles to, one pair of opposite edges.

It is concluded that the buckling stress ratios—i.e., the critical shear and compression stresses for combined loading expressed in terms of the corresponding critical stresses when acting alone—are practically independent of the dimensions of the panel. *Ministry of Aircraft Production, Aeronautical Research Committee R. & M. No. 1965.* British Information Services, New York, $0.60.

Ocean Front: The Story of the War in the Pacific, 1941–44. A 66-page booklet contains a large number of vivid pictures of the actual action in the various theaters of war in the Pacific. The pictures are accompanied by brief text matter and explanatory captions. The sections run chronologically, beginning with the attack on Pearl Harbor and following the advances of the Allied forces to the shores of the enemy homeland. Main sections give the details of the battles of Coral Sea and Midway, the campaign in New Guinea, the capture of the Solomons, the Aleutians, Central Pacific, and the Philippines. *British Ministry of Information.* British Information Services, New York, $0.30.

The Civil Aviation Communications Handbook deals with international procedure in connection with communication by radio and teleprinter. It defines terms and the various sections of the organization and International Telecommunication Services in the first part. Part II contains categories of messages used in the International Telecommunication Service, and Part III outlines the procedure for the transmission of messages. Part IV refers to messages regarding the movement of aircraft, outlining the procedure for departures, flights, and arrivals; control of aircraft movements; and landing procedures. Appendixes contain examples of radio procedure and instructions for teleprinter operators at stations in the United Kingdom. *British Air Ministry, Air Publication No. 1692.* British Information Services, New York, $0.45.

International Sanitary Convention for Aerial Navigation, 1944. Modifications for the International Sanitary Convention for Aerial Navigation that has been in effect since 1933 are out-

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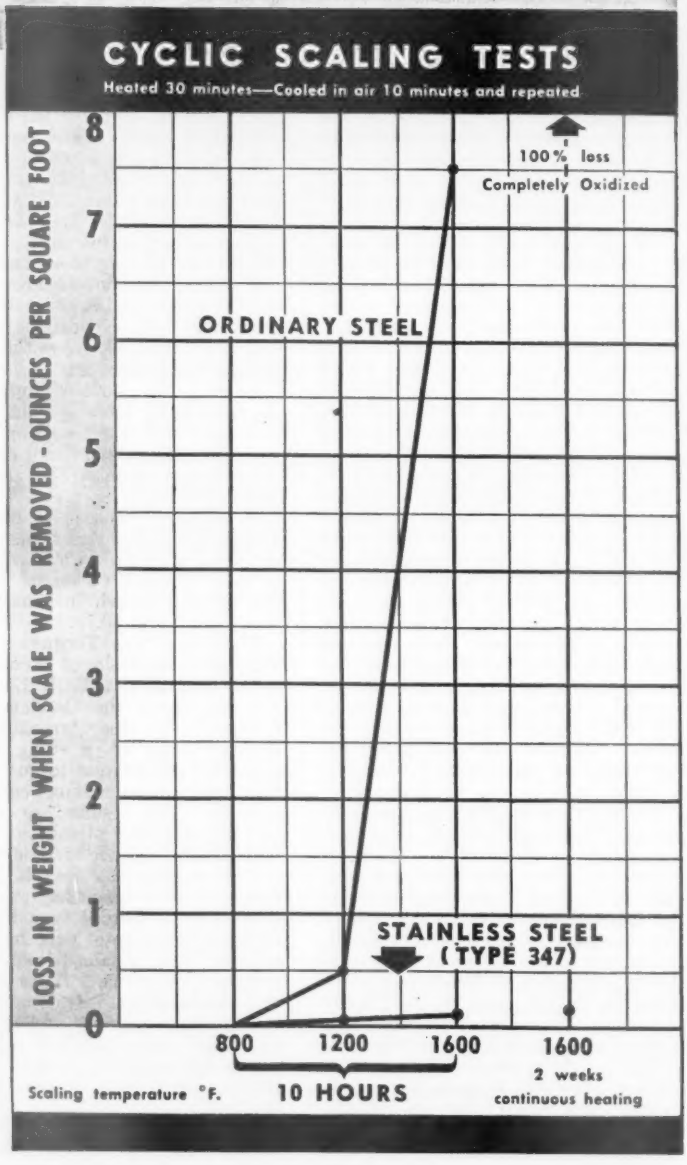

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lined in a pamphlet of 16 pages giving the detailed changes and amendments. Reference is made to each article in which revisions have been made effective, with the deletions and additions for each section. *British Secretary of State for Foreign Affairs.* British Information Services, New York, $0.10.

Dry Rot in Wood, Fourth Edition. K. St. G. Cartwright and W. P. K. Findlay. The fourth edition of a bulletin on forest products research gives attention to the prevalence of dry rot caused by general neglect in the upkeep of buildings during the war and damage caused by air raids. The revised edition incorporates new materials and changes dealing with new buildings, drawing attention to the precautions necessary to prevent decay of timber in some of the newer types of construction that may be used after the war.

The first part refers to fungi causing dry rot in wood; Part II refers to the detection and particular treatment of dry rot; and Part III deals with the precautions to be taken in the use of new timber to prevent outbreaks of dry rot. *British Department of Scientific and Industrial Research, Forest Products Research Bulletin No. 1.* British Information Services, New York, $0.30.

Direction des Industries Aéronautiques

L'Emboutissage et la Découpage des Tôles Minces dans la Construction Aéronautique (Stamping and Cutting of Thin Metal Sheets in Aeronautical Construction), Henri Portier. This report is a compilation of methods, machines, and machine tools used for metal construction by the aeronautical industry. Attention is drawn to the seemingly great similarity between the stamping methods applied in the automobile industry and those of the aeronautical industry, but the writer indicates the fundamental differences.

It is observed that, although the war has stimulated the manufacture of aircraft generally, the French aeronautical industry could not keep in step as a whole. Consequently, each factory worked according to the method best suited for its purposes, either by preference or by necessity.

This report had been started before the war, but all data gathered prior to 1940 have been destroyed by the bombing raids. In order to assist in the restoration of the disrupted organizations and to set a new standard, the writer did his work over again and reports his findings. Only actual facts are presented, while reference is made to the related publications in an extensive bibliography at the end of this report. *Publications Scientifiques et Techniques de la Direction des Industries Aéronautiques, Bulletin des Services Techniques, No. 100,* 1942.

Relation Entre la Pression d'Inflamation des Hydrocarbures et la Température (Relation Between the Ignition Pressure of Hydrocarbons and Temperature). Marcel Peschard. According to the writer, this is a continuation of his essay in No. 132 of these publications. Both investigations are intended to achieve a more scientific basis for hydrocarbons, instead of using arbitrary and empiric methods. The writer does not claim that his investigations will give the desired solution of the problem, but he believes that he is showing the right way to reach the goal.

After explaining the conditions that produce knock or detonation in an engine, he admits that the octane scale, from a practical point of view, has given considerable service. Nevertheless, he states and attempts to prove that, theoretically, it is nonexistent, and that this scale is not what may be considered a standard, since each engine has its own particular scale. This condition is the result of two varying factors, and its representation by one physical or physical-chemical magnitude seems improbable. *Publications Scientifiques et Techniques de la Direction des Industries Aéronautiques, No. 165,* 1943.

Alliages Légers Anticorrodables et a Hautes Propriétés Mécaniques (Corrosion-Resisting Light Alloys which Have High Mechanical Qualities). François Canac and Émile Segol. The writers made a systematic study of the various factors characteristic of the light alloys, such as proportion of magnesium, nature and proportion of additions, and heat-treatment. Their principal investigation was directed toward corrosion resistance. They used a bath consisting of caustic soda and oxygenated water for quick corrosion. In each case the results were checked with those obtained by either straight or alternating immersion in sea water. The aluminum-magnesium alloys seem to be the most corrosion resistant and have fine mechanical characteristics except for their elastic limits. A frequently neglected fact is the presence of impurities, such as iron and copper. They not only decrease the mechanical qualities of these alloys but also their corrosion resistance. In each case the structure was studied by means of a microscope or X-rays. After that the various mechanical properties were determined. In this report the writers present the various procedures of their investigation. The conclusions were as follows: Both aluminum and magnesium should be as pure as possible. The proportion of magnesium should be higher than 10 per cent, which has been the maximum so far. The proportion of 11.36 per cent corresponds to one magnesium atom to seven aluminum atoms and is especially recommended. Additions should be as pure as the aluminum and magnesium themselves. The heat-treatment should be such that these additions, as well as aluminum and magnesium compositions that this treatment may create, are properly distributed. *Publications Scientifiques et Techniques de la Direction des Industries Aéronautiques, No. 168,* 1943.

Secrétariat D'État a l'Aviation

Le Rivetage des Tôles Minces en Construction Aéronautique (Riveting of Thin Metal Sheets in Aeronautical Construction). Henri Portier. This is a revised and enlarged second edition of the first part of a report on the techniques of riveting thin metal sheets as applied in aircraft construction. The research was undertaken at the request of the French Air Ministry because of the lack of a self-contained publication on the subject.

Detailed consideration has been given to the technologic, metallurgic, structural, and economic points of view. The material has been collected from every available source, such as technical publications, patents, correspondence, visits to plants, etc.

The sections are as follows: regular and special rivets used in aeronautics; static tests of assembled parts and practical calculation design data; stress distribution around the rivets and between the various rivets of an assembled part; fatigue strength of riveted parts; effect of riveting pitch on the strength of a part made of thin sheet metal that is stiffened by means of profiles; effect of rivet heads on the aerodynamic characteristics of a wing profile. *Publications Scientifiques et Techniques du Secrétariat d'État a l'Aviation, Bulletin des Services Techniques No. 87,* 1942.

Identification de Sources Lunneuses Destinées aux Épreuves de l'Effet de Vieillissement dû a la Lumière (Identification of Light Sources to be Used to Prove the Aging Effect Caused by Light). Mrs. Douvillé-Lorillard. A report is made of the work undertaken in response to a request for a study of the spectral distribution of the energy emitted by various types of ultraviolet lamps used by Services Technique de l'Aéronautique for experiments on the artificial aging of paints, varnishes, etc., or by other types used in these tests. A further objective was to make a comparison of the various energy curves obtained with each type of lamp and then with the solar spectrum.

The report describes the testing arrangement and how the tests were carried out and gives the results of these tests. *Publications Scientifiques et Techniques du Secrétariat d'État a l'Aviation, Bulletin des Services Techniques No. 99,* 1942.

Un Nouveau Sensitomètre a Diaphragmes d'Ouverture (A New Sensitometer with Diaphragms on the Lens Aperture). Maurice Roulleau and Paul Lafouasse. A description is given of a new sensitometer designed to meet the need for an instrument to study the characteristics of a photographic emulsion under conditions that correspond to the actual operational conditions. These conditions call for a sensitometer that has a constant exposure time and is equipped with a carefully selected light source. The exposure times should closely approximate those used in practice. Other conditions that may have to be considered in the design of a new

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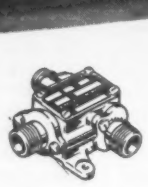
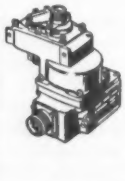
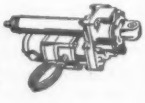
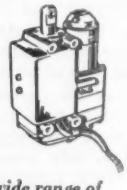


Eclipse Type 1601 Actuators utilize a central power unit to drive any combination of screw jacks through flexible shafts.



Eclipse Type 1600 Actuators are available in pairs (left and right hand) for application where simultaneous movement of two elements is desired.





Eclipse Type 1602 Actuators are small screw-jack types with integral motors, gearboxes and limit switches.

These are only a few of the wide range of types and models produced by Eclipse.

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sensitometer are outlined. The new unit was created because none of the existing devices gave full satisfaction. The report gives a description of the operation of the new instrument. *Publications Scientifiques et Techniques du Secrétariat d'état a l'Aviation, Bulletin des Services Techniques No. 101*, 1943.

Appareils, Procédés et Systèmes de Sensitométrie leur Diversité et Leur Unification (Sensitometric Devices, Processes, and Systems, Their Variety and Their Standardization). Maurice Roulleau. The author proposes a French standard for the study of the aptitude of photographic emulsions to be transformed into a more or less opaque medium under the effect of the energy to which they are exposed. He reviews the essential problems that have to be solved by sensitometry and states that the devices used for these investigations and the properties of the emulsions differ so much that the same sensitometric characteristics are liable to be differently expressed. Therefore, the evaluation of most of the sensitometric magnitudes are of value only if all operational conditions are specified. This calls for a standardization of the entire sensitometric procedure.

The writer believes that standardization may be realized within narrow limits, on a national scale, and gives an outline of his plan in this report. The proposed standard is based on emulsions that had been especially prepared for the French Air Force. *Publications Scientifiques et Techniques du Secrétariat d'État a l'Aviation, Bulletin des Services Techniques No. 102*, 1943.

Contribution a l'Étude de l'Auto-Inflammation des Combustibles Liquides (Contribution to the Study of Spontaneous Ignition of Liquid Fuels). Yvon Laure. The investigations published in this report deal with the application of the Diesel engine to aircraft and certain irregularities of its operation during high-altitude flights. Such operations pose the problem of the effect of pressure on the ignition temperature of the injected fuel. Because the pressure in the cylinders at the end of the compression stroke is much lower at high altitudes than on the ground, the ratio between the pressure at the end of the compression stroke and the intake pressure, together with the rate of compression, varies proportionally with the intake pressure, which is the atmospheric pressure at the point where the engine operates.

The adiabatic compression formula shows that the relationship of the initial temperature and temperature at the end of the compression stroke is a constant of the engine. *Publications Scientifiques et Techniques du Secrétariat d'État a l'Aviation, No. 162*, 1943.

Institute News

(*Continued from page 45*)

pilot. West Coast location preferred. Address inquiries to Box 349, Institute of the Aeronautical Sciences.

Tool and Gage Foreman—Past 5 years in designing, planning, and supervising gage manufacture. Experience covers other types of precision tools such as broaches, dies, etc. Previous experience in tool and die work outside of aircraft industry. Thoroughly versed in Tool Steel Heat Treating, Nitrioning Process, Stabilizing, Immersion type and Open Hearth Furnaces. Connected with large aircraft manufacturing plant. Seeking position as Foreman or Assistant Foreman with reliable firm, not necessarily aircraft. Willing to locate anywhere in United States and Possessions. Address inquiries to Box 346, Institute of the Aeronautical Sciences.

Registered Professional Aeronautical Engineer—Has successful consulting practice; would like to represent a responsible aviation corporation or air-line company in the Detroit and lower Michigan area. Graduate degrees from two universities; 8 years' experience as consultant, engineer, executive and professional man. Services could cover all fields such as engineering and sales contacts, technical and professional representative, etc. Permanent appointment with modest monthly retainer fee desired. Address inquiries to Box 345, Institute of the Aeronautical Sciences.

Senior Aerodynamicist—Over 20 years' experience in aeronautics. Excellent theoretical background. Now Research Engineer with big company. Desires permanent responsible position, preferably as Consulting or Research Engineer. Address inquiries to Box 344, Institute of the Aeronautical Sciences.

Aeronautical Engineer—B.S.M.E., University of Colorado; M.S. Aero. Eng., Massachusetts Institute of Technology. Five years' experience: 4 years with A.T.S.C., Engineering Division, Wright Field in Flutter, Aircraft Dynamic Load Measurement, and general development of mechanical and electronic instruments and recording equipment. Desires position in instrument research and development and flight test engineering. Address inquiries to Box 342, Institute of the Aeronautical Sciences.

Helicopter Chief of Structures—Two years' Chief of Structures, Sikorsky Aircraft, formerly Chief Stress Analyst other leading rotowing manufacturer. Licensed professional engineer, New York, New Jersey, Connecticut, Pennsylvania. Twenty years' structural designing background. Address inquiries to Box 341, Institute of the Aeronautical Sciences.

Engineer—B.Ae.E.; M.S. in M.E.; Ph.D.; Aeronautics major. Holds pilot's license and C.A.A. ratings to teach all phases of ground school. Prefers position in industry but will consider a university position with research and consulting possibilities. Location on west coast preferred but not a limitation. Address inquiries to Box 336, Institute of the Aeronautical Sciences.

Graduate Aeronautical Engineer—Bachelor and Master of Aeronautical Engineering degrees from N.Y.U. Two and one-half years' engineering in aircraft manufacturing and 2½ years' engineering in air-line maintenance and operation. Recently completed engineering and economic studies on major postwar aircraft for air-line operation. Will receive Masters in Commerce and Finance in 2 years. Draft exempt and release available. Excellent references. Address inquiries to Box 332, Institute of the Aeronautical Sciences.

Aeronautical Engineer—Pilot—Graduate engineer over 15 years' experience in design, research, and manufacturing; eight years as experimental test pilot; eighteen years' flying experience. Past employment includes several years as consulting engineer and chief engineer with large company. No objection to traveling. Address inquiries to Box 307, Institute of the Aeronautical Sciences.

Production Executive—Mechanical engineer with five years' administrative experience in all phases of aircraft construction including line assembly methods, tool and jig design, and one year as Director of Experimental. Served ten years as Works Manager of large plant fabricating precision metal parts for automatic actuating mechanisms. Thoroughly familiar with modern precision machine shop practice, serving eight years as Plant Manager. Manufacturing experience totals 26 years. Automotive background. Enjoys a wide acquaintance among subcontractors in central and eastern area. Will travel. Address inquiries to Box 292, Institute of the Aeronautical Sciences.

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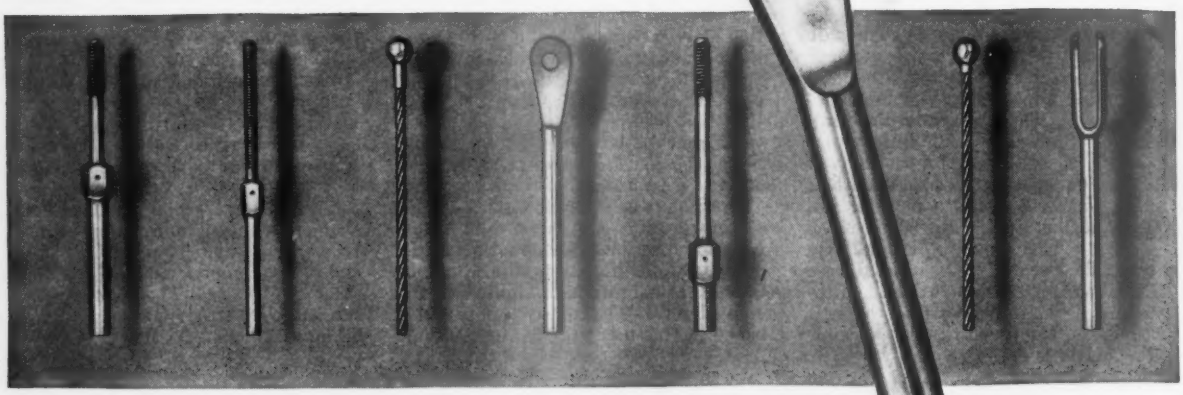

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BOOKS

Theory of Structures

S. Timoshenko and D. H. Young

Contents: Elements of Plane Statics; Statically Determinate Plane Trusses; Influence Lines; Statically Determinate Space Structures; General Theories Relating to Elastic Systems; Deflection on Pin-Jointed Trusses; Statically Indeterminate Pin-Jointed Trusses; Beams and Frames; Arches.

In preparing this book the authors have kept in mind the fact that the theory of structures is based on the principles of mechanics with which the student is familiar. A close relationship is established between the teaching of mechanics and structures to aid the student in understanding the various practical methods of analysis of trusses and frames.

Accordingly, the first chapter constitutes an introduction in which the basic principles of statics are recapitulated, with examples selected to show the adaptation of these principles to the solution of practical problems in the analysis of simple structures. In the second chapter the basic properties and functions of truss systems are explained, followed by a discussion of influence lines for beams and trusses. The fourth chapter studies the theory of space trusses, with complete examples.

Preparatory to the analysis of statically indeterminate structures, the application of general principles of mechanics are reviewed in the fifth chapter, the fundamental theorems are explained and elementary applications given, leading to the more complicated structures studied in the sixth and seventh chapters. These deal with methods of calculating deflections of trusses and the reactions and forces in redundant members.

The question of bending of beams and frames is taken up in the eighth chapter, beginning with the development and application of equations for prismatic beams, considering the solution of such equations by successive approximations, and ending with applications of the method to the analysis of continuous beams and frames continuing members of variable cross section. The final chapter treats of the theory of circles. McGraw-Hill Book Company, Inc., New York, 1945; 488 pages, $5.00.

The Airport Directory, 1945

Editor, J. Kirk Baldwin

Contents: State Airport Index; Map of Civil Airways and Airway Control Areas; Aviation Fuel Taxes; Aircraft Service Operators (Fixed Base Operators); CAA Approved Repair Stations; CAA Approved Aircraft and Engine Schools; CAA Approved Flying Schools; Collegiate Courses in Aviation; Map of Certificated Air Line Routes; Cities Served by Airlines; Certificated American Air Carriers; Civil Air Regulations; Civil Aeronautics Administration; Civil Aeronautics Board; Map of CAA Regional and District Offices; CAA Regional and District Office Personnel; U.S. Coast and Geodetic Survey Aeronautical Charts; U.S. Weather Bureau Offices; Airport Construction; State Aviation Boards and Commissions; Radio Range Stations; Digest of Air Traffic Control; Combined U.S.-British R/T Procedure; Radio Communications; Airport Buyer's Guide; Directory of Aircraft Manufacturers; Aviation Organizations and Associations; U.S. Aviation Firsts.

Offered as an annual service by the publishers of *Airports* magazine, this compilation of airport information will be most useful as an up-to-date guide to airports in the United States. Arranged by states and cities alphabetically, each airport in the cities is listed with the important facts that a pilot would wish to know. Airports used jointly for civilian and military purposes are listed, but no information is given about airports used exclusively by the Army and the Navy unless special permission has been granted.

More than a reference book about landing fields, this directory contains an abundance of flying data, information about Civil Air Regulations, air traffic control rules, flying schools, repair facilities, aviation organizations, Federal and state regulatory authorities, weather, radio-range and communication stations, as well as other pertinent information. The Haire Publishing Company, New York, 1945; 464 pages, $3.00.

With the exception of aeronautical annuals and books published outside the United States, books reviewed in this section may be borrowed without charge from The Paul Kollsman Library of the Institute of the Aeronautical Sciences, 1505 RCA Building West, 30 Rockefeller Plaza, New York 20, N. Y.

History of Aviation

N. H. Randers-Pehrson

Contents: The Early Stages; The Wright Brothers and Other Pioneers; Progress in Airplane Performance; The Beginning of Military Aviation and World War I; The Post War Period; Civil Aviation; Helicopters and Lighter-Than-Air Craft; Aviation and World War II.

To give a history of aviation in a book of 132 pages is a difficult task, therefore this compact record of the origin and development of flight has to be content with a running comment of the chronology of aviation. The beginnings of man's aspiration to navigate the air are sketched, the pioneering period of the airplane is surveyed, and subsequent developments are followed through to the work of aircraft in World War II.

Much research is evident in the attempt of the author to compress into a small book an outline of the extensive achievements of airmen. Each historian makes his own evaluation of the place of the early experimenters, some of which will always be challenged. Aside from such inevitable questions the book will serve a useful purpose in giving to those who want to know the background of flying an easy to read and well-illustrated record of this epoch-making vehicle of the air. National Aeronautics Council, Inc., New York, 1944; 132 pages, $1.00.

Psychology for the Armed Services

Edited by Edwin G. Boring

Contents: The Use of Psychology in War; The Eye as a Military Instrument; Visual Adaptation and Night Vision; Color and Camouflage; The Ear as a Military Instrument; Smell in War; Equilibrium and Bodily Orientation; Topographical Orientation; Efficiency and Fatigue; Physical Conditions of Efficiency; Selection of Men; Learning; Army Teaching; Motivation and Morale; Personal Adjustment; Emotion: Fear and Anger; Sex; Leadership; Rumor; Panic and Mobs; Assessing Opinion and Discovering Facts; Propaganda and Psychological Warfare; Differences Among the Peoples of the World; The Use of Psychology in War.

Intended as a textbook for use by members of the armed services for instruction and individual reading and guidance, this book covers a study of the

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application of the principles of psychology to men in all the armed services, although there is much useful material especially applicable to airmen. Considerable knowledge that will be valuable in the peacetime selection of recruits and in the observation of their conduct during service is contained in this work.

Since many of the terms used by psychologists have been too complex for the layman to understand, in this book the author and a committee of specialists have tried to use words whose meaning could be readily understood. The result is a book that will be useful to many who otherwise would find the subject too technical. The Infantry Journal, Washington, D.C., 1945; 533 pages, $3.00.

A Dictionary of Aeronautics

Edward B. French

This compilation, the work of an instructor in the Navy, gives a glossary of aeronautical and navigational terms which will make it particularly useful to naval airmen. It includes the pronunciation of many words that frequently receive various pronunciations.

Aeronautical dictionaries such as this one have a great advantage over the standard dictionaries because of the inclusion of terms, as well as words, used in aeronautics. Furthermore, as new developments take place and the meaning of many words changes, specialized dictionaries bring the terminology up to date. Mentzer, Bush & Company, Chicago, 1945; 129 pages, $1.00.

Introduction to Magnesium and Its Alloys

John Alico

Contents: Historical and Economic Development; Occurrence of Magnesium and Production of Magnesium Metal; Metallurgy of Magnesium and Its Alloys; Casting Magnesium Alloys; Forging, Rolling, Forming, and Extruding Magnesium Alloys; Heat Treatment and Surface Treatment of Magnesium Alloys; Machining Magnesium Alloys; Joining Magnesium Alloys; Magnesium to Be Postwar Factor in Product Design.

The fundamentals of magnesium and magnesium-alloy production and fabrication are set forth in this book. The volume has been written for manufacturers and design engineers who are considering magnesium-alloy applications for their products. It is also intended to aid research engineers, metallurgists, and students working in this field. The history and economic development of magnesium are reviewed. Consideration is given to production processes, the metallurgy of the material, and casting, processing, machining, and joining operations. Ziff-Davis Publishing Company, Chicago, 1945; 183 pages, $5.00.

Industrial Radiology and Related Phenomena

H. M. Muncheryan

Contents: Introduction; Dynamic Currents: The Atom and Electricity; Direct and Alternating Currents; The X-Ray Apparatus; X-Ray Tubes; X-Ray Radiations; Making a Radiograph; Photographic Effects of X-Rays; Diagnosis of Radiographs; Metallurgical Considerations; Photomicrographic Technique; Important Aircraft Materials; Radiography with Gamma Rays; Magnetic Inspection of Materials; The Atomic Structure: Part I, The Atomic Theory. Part II, The Nucleus; Absorption of Energy.

The author's aim in preparing this book has been to explain industrial radiography in a manner that would make it readily understood by laymen in the industrial field. The book has been developed partly from a course of lectures on the nondestructive inspection of materials given by the author at the University of Southern California, and partly from the author's experience as Chief Physicist of the Aircraft X-Ray Laboratories. The material is supplemented by the technical contributions of many professional workers in the field, X-ray research laboratories, technical societies, industrial metal manufacturing and founding firms, and the manufacturers of X-ray and metallographic equipment.

Information is given about the principles and the practice of modern methods of radiation and metallographic engineering. The diagnosis of industrial materials is explained. Aircraft X-Ray Laboratories, Huntington Park, Calif., 1943; 539 pages, $7.50.

Book Notes

The Story of the Winged-S, by Igor I. Sikorsky; Dodd, Mead & Company, New York, 1944; 276 pages, $3.00.

Seven years ago Mr. Sikorsky wrote the story of his career up to that time, which had been one of continuous pioneering and success. To bring the record up to date, in this edition he has added new material that describes his helicopter development. In a concluding chapter he sums up his life impressions.

Armament and History, by Major Gen. J. F. C. Fuller; Charles Scribner's Sons, New York, 1945; 207 pages, $2.50.

The author is an authority on military subjects. In this book he traces the development of ordnance, past and present, and points out how these things have influenced history.

He shows how the airplane raised war into the third dimension. In disputing General Douhet's theory of demoralizing industrial production and civilian morale by air power, he calls him a wonderful salesman but "a prophet of the ridiculous." He discusses strategic and tactical air power and pays tribute to the effects of supplying troops by air.

He believes that in the "Age of Oil" the airplane is the most important fighting machine using oil engines, and that it is the dominant weapon at sea.

Arnhem Lift, by Sgt. Louis E. Hagen; Farrar & Rinehart, Inc., New York, 1945; 82 pages, $1.50.

A German-born glider pilot who was imprisoned for opposition to the Nazis kept a diary of his experiences. Now published in book form "for the friends and relations of the men who did not come back," his diary tells how he escaped from a concentration camp, worked in an English tank factory, and later volunteered for glider duty. He was with the English troops who landed in Arnhem, Holland.

Selected Speeches and Statements of General of the Army George C. Marshall, edited by Major H. A. DeWeerd; The Infantry Journal, Washington, D.C., 1945; 263 pages, $2.75.

The Chief of Staff of the United States Army has issued many statements about the military program of the United States. In this volume, 48 brief historic addresses and statements made by him are reprinted so that the broad policy which he has advocated may be followed. Three of the chapters pertain to aviation.

Fighting Fleets, by Critchell Rimington; Dodd, Mead & Company, New York, 1944; 348 pages, $4.50.

The 1944 edition of this work gives a comprehensive view of those ships and airplanes that are representative examples of the fighting fleets of the world. Specialists describe the various divisions of sea power and the functions of the various units are explained. Naval air power and its importance in World War II are given a prominent place in the book. Aircraft carriers and naval planes are discussed in individual chapters, with excellent pictorial representation.

The excellence of the pictures used in the book is noteworthy. They give a broad idea of the many different units that go to make up a complete Navy. Tables giving lists and specifications of the naval craft of leading nations are added.

The new edition includes *The Naval Annual* in which specialists summarize the important naval activities of the year. The commentary on naval air power is contributed by Keith Ayling.

History of World War II, by Francis Trevelyan Miller; The John C. Winston Company, Philadelphia, 1945; 966 pages, $5.00.

A board of historical and military authorities has written this thousand-page

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RADIO AND OTHER ELECTRONIC EQUIPMENT FOR A WORLD ON WINGS

history of the war under the direction of the author. It presents a detailed panorama of the greatest war in history, with authentic text, official photographs, maps, records, and documents.

The Pan American Yearbook 1945; Pan American Associates, New York, 1945; 829 pages, $5.00.

Part One of this 1945 yearbook presents an analysis of the historical development of the Americas. Part Two describes each of the 22 individual nations of the Western Hemisphere, and Part Three consists of a list of more than 25,000 firms and representatives, classified according to industry and alphabetically within each country.

A special section is devoted to firms that are engaged in aeronautical manufacture and services, listing manufacturers, distributors, retailers, importers, and exporters.

Stronger than Fear, by Richard Tregaskis; Random House, New York, 1945; 144 pages, $2.00.

A story of an attack through a German city, written by one of the best-known war correspondents. He realistically portrays the conquest of fear during the struggles of a group of men who were soldiers of the best type.

New Zealanders in the Air War, by Alan W. Mitchell; George G. Harrap & Company, Ltd., London, 1945; 192 pages, 5*s*.

Some of the notable achievements of the pilots who came from the island dominion "down under" are recounted in this book. In addition to the records of 17 of the outstanding pilots of the Royal New Zealand Air Force, there is given a general history of the Air Force and that of No. 75 Lancaster Squadron, No. 487 Mosquito Squadron, No. 485 Spitfire Squadron, No. 488 Mosquito Night Fighter Squadron, No. 486 Tempest Squadron, and No. 489 Torpedo-Bomber Squadron.

Der Ultraschall und seine Anwendung in Wissenschaft und Technik (Supersonics and Its Application in Science and Industry), by Ludwig Bergmann; VDI-Verlag GmbH, Berlin, 1942; published and distributed by authority of the Alien Property Custodian by Edwards Brothers, Inc., Ann Arbor, Mich., 1944; 445 pages, $9.50.

A manual of supersonics and its applications in which the author devotes the main part of the work to the experimental phase of supersonics, giving consideration to the theory only to the extent necessary for a better understanding of the subject.

It is stated that among physical phenomena supersonics is one o. the few which have been applied within such a short period of time to almost all branches of science and industry. As the material on this subject is so extensive, the author has been unable to present all of the data in detail. Therefore he refers to the comprehensive bibliography at the end of the book.

The Fightin'est Ship, by Lt. C. G. Morris with Hugh B. Cave; Dodd, Mead & Company, New York, 1944; 192 pages, $2.50.

The story of the cruiser "Helena," up to the action in which the ship was finally sunk in Kula Gulf, is one of those heroic epics that make Navy tradition. The record of the ship in the southern Pacific was written by one who was aboard during the many battles in which she participated.

Sunday at 09.30 Hours, by Chaplain Arthur J. Hichens; The Epworth Press, London, 1944; 63 pages, 3*s*. 6*d*.

A Methodist preacher who gave Sunday addresses to men at a Royal Air Force Station in England has collected them in this book. They are inspirational talks of a kind that airmen can listen to with interest.

The clergyman demonstrates that he has mastered the difficult art of being convincing by using simple illustrations from daily life and interpreting their relationship to religion.

Allied and Enemy Aircraft (West and South European Area); Gale & Polden Limited, Aldershot, England, 1944; 56 pages 2*s*.

A pocket guide to the most important British, American, and German aircraft, with identification notes, by a member of the Royal Observer Corps. Silhouettes show the essential characteristics of each plane and brief notes tell about its power plants, span, and speed.

This Is the Navy, by Critchell Rimington; Dodd, Mead & Company, New York, 1945; 171 pages, $2.75.

In this pictorial story of the U.S. Navy, accompanied by descriptive text, the reader is shown how the Navy fights and how it plays. The air arm is given a prominent place but the overall impression is that of an integrated team of naval specialists.

Rudiments of Aircraft Recognition, by Eric Wilton; Sampson Low, Marston & Company, Ltd., London, 1945; 182 pages, 7*s*. 6*d*.

Airplane identification may become a hobby with older, as well as younger, people, much as automobile identification has always been. The author, after experimenting with different systems of classification, adopted a simple and logical method by which a person with little or no experience may become an expert in the art.

He classifies airplanes by operational functions, recognition features, and mark numbers, and initiates the reader into the "mysteries" of a most interesting as well as useful avocation.

Take-Off at Dusk and Other Poems, by Flight Lt. Peter Roberts; Frederick Muller, Ltd., London, 1944; 34 pages, 5*s*.

Written by an R.A.F. navigator while he was a prisoner of war after having been shot down off the coast of Norway, these short poems have the quality that ordinarily comes from leisurely contemplation. Each poem was received in England by prisoners' mail, and the collection is now published for those who like to read the observations of an airman with ideals and a poetic flair.

Alcoa Structural Handbook; Aluminum Company of America, Pittsburgh, 1945; 215 pages, $1.25.

The second edition of the Structural Aluminum Handbook presents fundamental information regarding the ultimate strength of structural members fabricated from aluminum alloys. These data, given in the form of descriptions, examples, and tables, are based on laboratory investigations, field tests, and extensive practical experience. The progress made in the manufacture of aluminum-alloy structural products and in the design and fabrication of structures employing these products is reflected in the enlarged scope of the present volume.

The section on characteristics, manufacture, and fabrication has been enlarged and brought up to date, and a section has been added containing commercial sizes, tolerances, and specifications. The tables of elements of sections for structural shapes have been expanded, and values for torsional constants, together with notations on the present availability of sections have been added. Elements of sections for rectangular shapes and tubes have been included and arranged to facilitate computation. The calculations involved in the preparation of the book are based on the theoretic cross sections as shown in the tables. It is noted, however, that in practice these sections vary according to the commercial tolerances shown in the tables.

I've Had It, by Col. Beirne Lay, Jr.; Harper & Brothers, New York, 1945; 141 pages, $2.00.

One of the best-known writers in the aeronautical field gives a vivid account of a mission over Germany when his plane was disabled, making it necessary for him and his crew to descend while returning over France. There he and a lieutenant were sheltered by some French families until the Americans broke through the German lines and rescued them.

Colonel Lay is at his best in recounting the risks that these patriotic civilians took to render aid to American and English officers and soldiers, through the "underground."

Runway to the Sun, by Col. Robert L. Scott, Jr.; Charles Scribner's Sons, New York, 1945; 218 pages, $2.50.

The autobiography of the author of that best seller, *God is My Co-Pilot.* Colonel Scott describes the obstacles he overcame to enter West Point, how he trained at Randolph Field and then followed the routine service of an Air Force officer until he was ordered to China to serve under General Chennault. He served with the Army pilots who flew the air mail and later made many cross-country flights.

The reader is given a picture of how the older pilots of this war secured their training and were able to lead the younger men in combat.

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AC Ceramic Spark Plugs again have done their part in the accomplishment of another signal pioneering flight. Yes, AC's were used in the recent non-stop flight of 3 Army B-29 Superfortresses from Hokkaido, Japan, to Chicago. The distance, 5,995 miles, and the average time, 26 hours plus, demanded *utmost reliability*—and 144 AC Spark Plugs in the 4 Wright engines of each plane met that requirement.

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High Adventure, by John Stannage; H. W. Bullivant Company, Ltd., Christchurch, New Zealand, 1944; 195 pages, 2*s*. 6*d*.

The exploits of Sir Charles Kingsford Smith constitute one of the great pioneering epics of aeronautical history. The author, who was the radio operator on many of the historic flights made by Kingsford Smith, gives in this small book his intimate observations of these world-wide aerial trips.

It is not fiction but a true story of one of aviation's most daring and forward-looking pilots.

Superiority of Fire, by Major C. H. B. Pridham; Hutchinson's Scientific and Technical Publications, London, 1945; 146 pages, 10*s*. 6*d*.

The history of rifles and machine guns is traced from their origins. Those who have to use these weapons are given a better understanding of their influence on warfare and development over nine centuries.

All types of these firearms are described. An important chapter on machine guns in air warfare is included.

Wings Over the Desert, by Graham M. Dean; The Viking Press, New York, 1945; 224 pages, $2.00.

A cub reporter physically unfit for the armed services decides to become a pilot and do his "bit" for the Civil Air Patrol in the Western desert country. He becomes involved in attempted sabotage, forest fires, exciting rescues, and a long series of other unusual adventures.

The story reveals the unselfish activity of members of the C.A.P. who did so much to aid local and governmental authorities to uncover subversive efforts.

Structural Design Manual; The Glenn L. Martin Company, Baltimore, 1945; various paging.

Drafting Room Manual; The Glenn L. Martin Company, Baltimore, 1945; various paging.

G.L.M. Standard Shapes, Bent-Up, Extruded, Tubing, and Rubber; The Glenn L. Martin Company, Baltimore, 1945; various paging.

Three books in ring-bound form outline the engineering standards and practices that have been established for the respective classes of work in the Engineering Department of The Glenn L. Martin Company. They are arranged in loose-leaf form so that revisions and additions can be readily made, keeping the books continuously up to date.

Structural Design Manual is intended to make available to the members of the Structures Department structural information and data not readily found elsewhere. The type of information supplied includes stress analysis, design procedures, allowable stresses, special design loads, rivet and bolt allowables, and special requirements. It supersedes the Structures Bulletin. The pertinent material contained in the bulletins has been revised and is included; obsolete portions are omitted. The procedures for estimating the strength of columns and sheet stringer panels, and the crippling strength of thin sections and flat plates are new. The rivet data of Structures Bulletin No. 18 have been extensively revised and brought into line with the latest available information.

Derivations of formulas have been omitted in order to save space and make the volume easier to use. References are given to the sources where the derivations and basic data can be found. The limitations of the procedure and range of applicability of the data have been indicated wherever possible. The *Structural Design Manual* is intended to be a tool to help the designer plan his structures.

The primary function of the *Drafting Room Manual* is to serve as a guide and handbook to the Engineering Department in general. It endeavors to supply all necessary information for the preparation of efficient working drawings. In order that it may fulfill its function most satisfactorily, it should not only set forth the company's drawing system and general procedures, but it should also be as complete a source as possible of pertinent design information. Consequently, the major engineering design topics are covered in considerable detail from the aeronautical standpoint, in the several design sections. These sections provide ready answers to a large majority of the problems confronting the aircraft engineer and help to reduce the time spent on basic design. As new design information becomes available it is incorporated in the sections as revisions or additions.

It is noted, with reference to the drawing system, that there may be instances where a seemingly complicated procedure has been followed when a simpler one might have answered the purpose from a draftsman's standpoint, but the requirements of other departments have been kept in mind so that the system can operate to the greatest mutual advantage.

GLM Standard Shapes contains data in the form of tables and drawings showing the established manufacturing standards to which plant operations must conform. The book is divided into major sections designated as Sheet-Metal Shapes; Extruded Shapes; Tubing; Rubber Shapes; Forgings, Impact Extrusions, and Castings. Each section is indexed and is divided into appropriate subsections.

Engineering Precision Measurements, by A. W. Judge; Chapman & Hall, Ltd., London, 1944; 310 pages, 25*s*.

A survey of the important methods of precision measurements employed in engineering workshops. Some of the more widely used methods are described in detail from the point of view of the user in the gage room, inspection department, toolroom, and machine shop. Information is given about methods of measurement based on the use of mechanical magnification instruments and the more recently introduced instruments utilizing physical principles which enable a high degree of measuring accuracy to be attained.

Advancing Fronts in Chemistry, edited by Sumner B. Twiss; Reinhold Publishing Corporation, New York, 1945; 196 pages, $4.00.

A series of lectures delivered at Wayne University in the Spring of 1944 in connection with a high polymer program is published in this volume. The series represents an attempt to correlate recent and diverse experimental information about the higher polymers, that is, rubbers, plastics, and fibers. It sets forth the unified concepts of certain phases of the polymerization problem as they are understood and interpreted by various experts in the field.

Internal-Combustion Engines, by V. L. Maleev; McGraw-Hill Book Company, Inc., New York, 1945; 636 pages, $5.00.

In this second edition of a text on the theory, design, and operation of internal-combustion engines, five new chapters have been added on combustion in spark-ignition engines; combustion in compression-ignition engines; compression-ignition combustion chambers; supercharging; and gas turbines.

Textbook on Spherical Astronomy, by W. M. Smart; University Press, Cambridge, Mass., 1944; 430 pages, $4.75.

The fourth edition of a book based on lectures given annually at the University of Cambridge and in a parallel course of instruction in practical astronomy at Cambridge Observatory. It has been revised to include current practice and modern developments in spherical astronomy.

A.S.M.E. Mechanical Catalog and Directory, 1946; The American Society of Mechanical Engineers, New York, 1945; 824 pages, $3.00.

The 35th annual volume of the A.S.M.E. Mechanical Catalog and Directory has been expanded in scope and in number of insertions. It is offered to the engineering profession to tell American industry where it can obtain the machinery and materials for replenishing its stock shelves for the task of reconversion from war to peace.

The Catalog section contains descriptions of hundreds of items used by industry in manufacturing its products and in maintaining its plants. Information is supplied by the manufacturers. The catalogs are arranged in alphabetical order, according to the names of manufacturers, with some exceptions caused by the make-up requirements.

The Directory section indexes additional sources of equipment, machinery, and supplies needed by the mechanical engineer. In numerous instances further particulars are given concerning the products.

The Trade Names section consists of an alphabetical list of trade names supplied by the firms listed. The concluding section lists the publications of the A.S.M.E., supplying information about the codes, standards, periodicals, and other publications.

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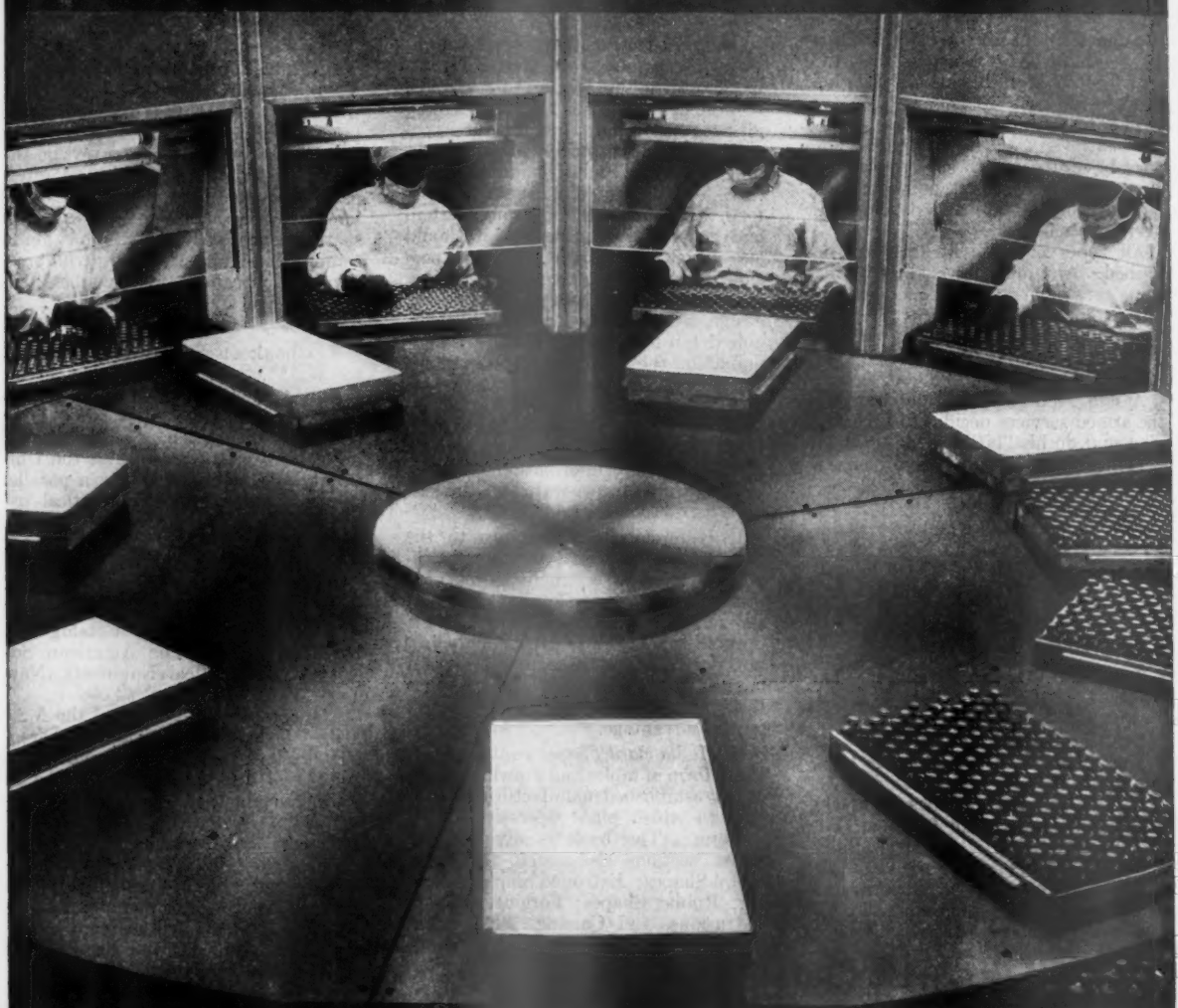

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THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N.Y.

Oceanography for Meteorologists, by H. U. Sverdrup; George Allen & Unwin, Ltd., London, 1945; 246 pages, 12*s.* 6*d.*

A book written for the purpose of supplying information regarding findings in physical oceanography that have bearing on problems of the atmosphere. Besides describing the methods used in physical oceanography, the author summarizes present knowledge of the ocean and the processes that maintain the currents.

Strength of Materials, by Alfred P. Poorman; McGraw-Hill Book Company, Inc., New York, 1945; 339 pages, $3.00.

A number of changes and additions have been made in this fourth edition of a text on the strength of materials, to bring the book abreast of present-day knowledge. The relation between the value of the modulus of elasticity in shear and that in tension for homogeneous isotropic materials has been developed. On account of the increased use of aluminum, duralumin, and magnesium columns in airplanes and other structures, an article on such columns has been added. Allowable stresses have been changed to agree with the higher values now permitted by authoritative specifications.

Principles of Industrial Process Control, by Donald P. Eckman; John Wiley & Sons, Inc., New York, 1945; 237 pages, $3.50.

Intended primarily for the student in chemical, metallurgic, mechanical, or electrical engineering, this book is devoted to the science of automatic control of industrial processes. It provides the reader with a summary of the laws of operation of industrial automatic control systems and a practical background of theory. The analysis is restricted to more or less highly developed theories applying to particular problems. The importance of proper measurement because of its great influence on automatic control is emphasized. The book should also be useful as a reference for the industrial user of automatic control equipment.

Power and Speed, edited by Frederick E. Dean; Floyd Clymer, Los Angeles, 1944; 112 pages, $2.50.

Directed to the younger generation, this book, which is an American edition of an English publication, deals with the internal-combustion engine in its varied spheres of use. Information is supplied about private automobiles, racing cars, and motorcycles. One section is devoted to the airplane and its engine.

The different sections have been written by specialists in each field, the contributors including several famous racing drivers, designers, pilots, and editors and staff members of various British technical journals.

The Dynamics of Time Study, by Ralph Presgrave; McGraw-Hill Book Company, Inc., New York, 1945; 238 pages, $2.50.

An analysis of the essential principles to which sound time-study technique must conform, and a description of practical methods for applying these principles. To some extent it is a philosophic approach, relating time study to the fundamental physical capacities of human individuals when performing manual work. The author's purpose has been to provide time-study technicians and executives with a groundwork of principles by which their methods may be analyzed and improved.

A Treatise on Applied Hydraulics, by Herbert Addison; Chapman & Hall, Ltd., London, 1944; 614 pages, 32*s.*

The third edition of this book on fundamentals and applications of hydraulics has been expanded and revised. The number of explanatory notes and examples has been increased and the bibliography has been enlarged. Additional information is given about frictional loss in closed and open conduits; pressure and thrust on immersed solids; pressure distribution on pump and turbine blades, and its relation to cavitation and suction lift.

Ball and Roller Bearing Engineering, by Arvid Palmgren; SKF Industries, Inc., Philadelphia, 1945; 270 pages.

Written to serve as a text on all phases of ball- and roller-bearing applications to industry, this volume begins with a technical description of common bearing types and continues through nine chapters of fundamental engineering studies. Sections deal with the forces and motions in bearings, the carrying capacity of ball and roller bearings, bearing selection, the design of bearing applications, mounting and dismounting, lubrication and maintenance, and bearing failures. A table of conversion values and a list of symbols and abbreviations are included.

Procedure Handbook of Arc Welding, Design and Practice; The Lincoln Electric Company, Cleveland, 1945; 1282 pages, $1.50.

New material has been added to this eighth edition of a reference book on arc welding. The book contains detailed information about the arc-welding process in its various forms, as well as essential data for its use in welding various types of steel, iron, and nonferrous metals. A large section is devoted to designing for the arc-welded construction of machinery and structures.

An Outline of Industrial Metallurgy, by D. G. P. Paterson and J. Bearn; Chapman & Hall, Ltd., London, 1944; 185 pages, 12*s.* 6*d.*

Based on a series of articles which appeared in *Sheet Metal Industries,* but containing additional material and illustrations, this book is concerned with some important aspects of industrial metallurgy. The book has been written to provide an introduction to the subject for nonspecialists, to give some indication of the close link between the laboratory and the works, and to enhance the student's interest in work of a more "academic" nature.

Floyd Clymer's Historical Motor Scrapbook, Number 2; Clymer Motors, Los Angeles, 1944; 224 pages, $1.50.

Reproductions of descriptive articles and illustrations, as well as contemporary advertisements of old-time automobiles, have been assembled in the second edition of a scrapbook of automobile history. Almost the entire contents of the book refer to automobiles, but in the author's sketch of his own life reference is made to some of his activities in connection with aircraft, accompanied by illustrations of a few aerial events and races between airplanes and automobiles.

Handbook of Nonferrous Metallurgy, Donald M. Liddell, Editor-in-Chief; McGraw-Hill Book Company, Inc., New York, 1945; 656 pages, $6.50.

Part I of a two-volume handbook for metallurgists is offered in revised form. It deals with the principles and processes of nonferrous metallurgy. Information is supplied about the operations, apparatus, and methods fundamental to the various branches of nonferrous metallurgy. A large amount of data on the subject is included.

The Testing of High Speed Internal Combustion Engines, by Arthur W. Judge; Chapman & Hall, Ltd., London, 1944; 462 pages, 42*s.*

Developments in engine-testing methods and apparatus that have taken place since the previous edition of this book was published have necessitated a fairly complete revision of both the text and illustrations. In making revisions the author has paid particular attention to dynamometers, aircraft-engine testing methods, and American test equipment. New chapters have been added on the cathode-ray indicator and the compression-ignition engine.

The Model Aeroplane Manual, by Lawrence H. Sparey and Charles A. Rippon; Percival Marshall & Company, Ltd., London, 1944; 236 pages, 7*s.* 6*d.*

In this third edition of a guide for model-airplane builders, a considerable amount of new material has been added. Designs for new aircraft are supplied. Information is given about the technique of flying model airplanes.

Plane and Spherical Trigonometry, by Harvey Alexander Simmons; John Wiley & Sons, Inc., New York, 1945; 387 pages, $2.25.

A revised and expanded edition of an earlier volume on plane trigonometry. The subject of spherical trigonometry is dealt with in greater detail than is usual in textbooks on trigonometry. Applications of spherical trigonometry to navigation, nautical astronomy, and surveying are included. New chapters on the slide rule, complex numbers, and solid geometry have been added.

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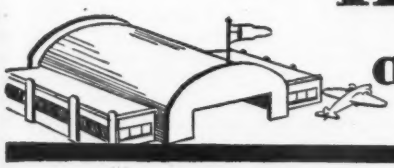

Speeding Aircraft Manufacture

A Key to Preparedness for Mass Production. Richard S. Boutelle. Recommended as an example to be followed for war-production preparedness during peacetime, an account is given of the principles and procedures that were utilized in the manufacture of the Fairchild C-82 Packet. As related, these were based upon the concept of beginning quantity-production planning at the design level. They also incorporated the recording of all production experience and information for the possible use of other manufacturers. *The Pegasus*, November, 1945.

Aircraft Instruments

Gyro Signal Transmitters and Stabilizing Gyros. Another of a series of technical instruction booklets refers to transmitters for roll, pitch, and azimuth signals, roll and pitch stabilizers, and phase adapters and inverters. It contains descriptions of the instruments and detailed specifications and drawings showing their dimensions. *Publication No. 16-44.*

Gyro-Magnetic Compass. Descriptions and specifications of the Sperry Gyro-Magnetic compass are contained in one of a series of booklets. Applications of the compass to surface vessels are given primary consideration. Equipment for use with the Gyro-Magnetic compass is included, such as the repeater and a motor generator for the operation of the instrument. Specifications are tabulated, and drawings show the dimensions and locations of the various units. *Publication No. 17-15. Sperry Gyroscope Company, Inc.*

Aircraft Starters

Eclipse Lightweight Aviation-Engine Starter. A 4-page folder contains brief specifications and illustrations of the Types 1416 and 1423 lightweight direct-cranking electric starters for aircraft engines. Applications, weights, and other design features are emphasized. *Eclipse Aviation Accessory Design Check Chart No. 18, Eclipse-Pioneer Division, Bendix Aviation Corporation.*

Fuel-Measuring Instrument

The Simmonds Pacitor Gauge is a 10-page catalog describing an electronic fuel gage designed for commercial transport airplanes. It describes the method of operation of the device, as well as the component parts and their installation in the airplane. *Simmonds Aerocessories, Inc.*, New York.

Equipment for Testing Vibration

Vibration Test Equipment is a 4-page folder with inserts, containing descriptions of the construction and application of machines for making vibration studies. The use of the equipment is explained, and specifications are given concerning several models of vibration tables and test stands. *L. A. B. Corporation*, Summit, N.J.

Air and Hydraulic Cylinders

Bulletin A-103 gives dimensions, specifications, and other data about a group of air cylinders of steel construction having features stated by the manufacturer to be unusual. The features are described, and the dimensions of the various models are given in tables and drawings. Similar information about hydraulic cylinders is given in *Bulletin H-104. Miller Motor Company*, Chicago.

Metal Parts Production Methods

Non-Ferrous Parts Production is an illustrated data book containing descriptions and chemical and physical specifications of a group of mechanical parts made of nonferrous alloys. It includes alloys of bronze, manganese bronze, yellow brass, aluminum bronze, silicon bronze, nickel bronze, and special bearing alloys. In addition to the specifications, there are descriptions and illustrations of the manufacturer's plant facilities. *Metal and Alloy Specialties Company, Inc.*, Buffalo, N.Y.

Design of Transparent Parts

Plexiglas Design Manual. One of a series of technical booklets covering optical properties, mechanical properties, fabrication, and installation of Plexiglas, this manual provides a summary of optical considerations in the design of transparent parts. It deals also with the fabrication considerations in the manufacture of the material and discusses methods and means of molding Plexiglas parts. Principles of light control and piping in the use of Plexiglas components to redirect, concentrate, or diffuse light are outlined. *Rohm & Haas Company*, Philadelphia.

Precision Threading and Stamping in One Operation

Thredstamp. Applications and advantages of the Thredstamp process are demonstrated in a 1-page bulletin. A chart shows the use of the process in the manufacture of a protective plug. It is explained further that this method makes it possible to blank, draw, thread, and swage in one operation. *Tubing Seal-Cap, Inc.*, Los Angeles.

Aircraft Fuel Pumps

For Highest Performance is a folder illustrated in color, containing a brief review of the manufacturer's war activities and current production work. Among the products described and illustrated are the Titan aircraft fuel pumps. *Candler-Hill Corporation, Division, Titan Pump and Engineering Corporation*, Detroit.

Airplane Controls

Simmonds-Corsey Controls. A 6-page leaflet outlines the design, construction, features, operation, and applications of these aircraft controls. It also tells about the design handbook that is available for the controls and includes a diagram showing a typical control layout. A 2-page enclosure consists of data about another aircraft-control device, the Radian Unit—designed to convert linear motion into angular travel with the required accuracy of control. This unit is recommended by the maker for providing positive rotary-motion action from push-pull operation for propeller governors, carburetor air controls, supercharger controls, and similar installations. *Simmonds Aerocessories, Inc.*, New York.

Air-Line Statistics

Delta Air Lines Annual Report 1945. In addition to the financial statements contained in the usual annual report of a corporation, the operators of the Delta Air Lines have published statistics about the activities of the company in such a way as to be understandable to the average reader. Among the facts presented in figures and in graphic form are those regarding the man-power requirements for the operation and maintenance of a transport airplane, the earnings and operating expenses per airplane, and the distribution of the company's total revenue for the year. Other charts show the volume of business and its classifications, and information concerning the company's future plans is included. *Delta Air Corporation.*

Hydraulic Machinery for Industrial Plants

H-P-M All-Hydraulic Presses for Modern Pressure Processing. An illustrated book of 84 pages contains brief descriptions of a wide variety of hy-

draulic machinery for industrial applications, together with illustrations of the machines in action, and of the products made. There are brief descriptions of the design, construction, and operation of each type of machine. Although the book deals with the general applications of hydraulic machinery in industrial plants, several of the types of machinery described are those used in the manufacture of aircraft. *The Hydraulic Press Manufacturing Company*, Mount Gilead, Ohio.

Machine Tool Aids to Industry

Machines, Prices, Jobs is the title of a booklet that reviews the contributions made by machine tools to the improvement of industrial products and the advancement of employment. It contains facts concerning the relationship of employment and prices to the use of machine tools, showing in general how the mechanization of industrial plans has brought about increases in employment, as well as the improvement of industrial products. *National Machine Tool Builders' Association*, Cleveland.

Forgings in Aircraft Construction

Forgings for Aircraft is the title of a 20-page, three-color booklet showing how forgings have overcome many of the problems involved in aircraft construction. Various types of aircraft forgings are described and illustrated. Alloy steels, stainless steel, copper-base alloys, and light alloys are analyzed and identified as materials for aircraft forgings. The advantages of tin alloying elements are also given.

The four general types of precision forgings suitable for aircraft parts are described and include drop forgings, machine or upset forgings, press forgings, and smith forgings. *The Steel Improvement & Forge Company*, Cleveland.

Chemists Help Build Aircraft Engines

Chemistry Guards the Aircraft Engine. Richard B. Faurote. The chemist's role in the production and quality control of aircraft engines is outlined. Particulars are given about procedures and equipment utilized in the various chemistry phases of engine manufacture. *The Pegasus*, November, 1945.

Aircraft-Equipment Instructions

Eclipse Service Manuals. Four new Eclipse service manuals have been issued. Together with a parts catalog and illustrative drawings, *Manual No. 11* contains installation, operation, and overhaul instructions for the electric propeller governor control head, type 493. *Manual No. 15* includes similar information for voltage-booster dynamotors types 883-1-B and 983-1-B. *Manual No. 32* consists of instructions and catalog for fluid pump type 744; fluid filter type 712; rheostats types 566 and 597, parts Nos. 52415 and 96917; and fluid check valve type 568. In *Manual No. 60* there are directions for the installation, operation, and overhaul of retracting unit types 1061, 1063, 1064, and 1065.

Each of the four manuals is divided into separate chapters, one of which describes the equipment; another, how to install it; and a third, how it should be operated. In addition, there is a chapter in each booklet dealing solely with service inspection, maintenance, and lubrication. Another chapter contains instructions for disassembly, inspection, repair, and reassembly. Test procedure is outlined. *Eclipse-Pioneer Division, Bendix Aviation Corporation.*

Synthetic-Rubber Parts

Mechanical Molded Parts of Synthetic Rubber is a 32-page primer-style book designed as a guide to show engineering departments the best way to undertake the development and procurement of parts molded from synthetic rubber. It gives typical development procedure worked out during the war, lists the 14 laboratory controls used, and gives detailed information about molds and trimming fixtures that are peculiar to synthetic-rubber parts.

It shows how specifications are developed and contains pictures and descriptions of raw materials and five principal manufacturing steps of compounding, molding, extruding, calendering, and inspection. *Aero-Seal Rubber Products*, Chicago.

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TO BOX 403
AERONAUTICAL ENGINEERING REVIEW

British Plane for Trunk Air-Line Transport

The de Havilland Dove. This illustrated pamphlet is divided into four chapters. The first evaluates in general terms the characteristics, advantages, and functions of the de Havilland Dove. The second indicates the main features of the plane. The third discusses its compliance with economic considerations, and the fourth surveys the airplane's construction. For its primary purpose, the Dove is recommended as having been designed to serve tributary airways that have need for small aircraft seating from 8 to 11 passengers and can count upon 800 to 1,000 hours of duty in the year, with loadings averaging at least one-half to two-thirds of capacity. *The de Havilland Aircraft Company, Ltd.*

Transport Airplane

The Martin Model 202. Features of the Martin Model 202 are reviewed in a 40-page booklet. In addition to illustrations and tables of data, the booklet offers a summary of the development that led to the design of the Model 202, a performance summary, a weight summary, and an account of the operating costs. Accommodations of the aircraft, its ground-handling efficiency, its maintenance and accessibility, and its safety characteristics are among the phases of design and operation which are noted. Optional equipment is described. *The Glenn L. Martin Company.*

Traffic-Control Equipment

Traffic Control without Pilot Effort. The Teleregister system of automatic aids for air-traffic control is described in an illustrated, ring-bound book of 97 pages. It shows how a centrally controlled, electrically operated system for transmitting stock-market quotations to brokerage offices was adapted and applied to the control of air traffic. The book is divided into five parts, the first of which reviews the operations of the Civil Aeronautics Administration. It describes the method of airway-traffic control prepared by the Federal authorities and the manual methods of executing these traffic-control plans, as well as the means of keeping records.

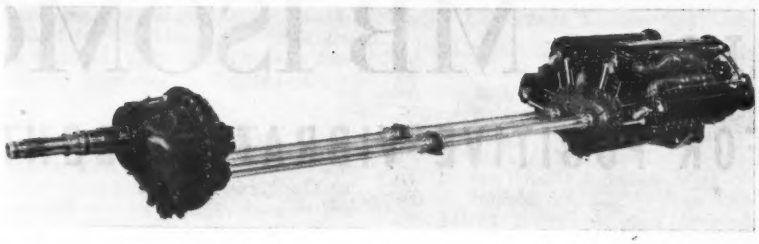
The second part gives the details of planning automatic equipment for air-traffic control, outlining the principles and the limitations of the present manual methods. A mechanical method is then suggested, with a description of the four steps by which the mechanical system is put into service.

Part III gives details of the system of communication between airports and the control center and information about the equipment, which includes the Western Union Teleregister and a specially developed Transmityper, a photoelectric transmitting typewriter. Details are given about such equipment, its accessories, installation, and operation.

Part IV gives a complete description of the airway traffic-control room and the equipment installed there, with a full recital of the operation of the system.

Part V traces the actual operation of the system and its functioning, based on the installation at La Guardia Field and other airports with which the system is connected.

An appendix contains comments about the apparatus and methods for the benefit of equipment engineers and others concerned with performance and maintenance of mechanical air-traffic control equipment. *The Teleregister Corporation,* New York.



The Allison V-3240 24-cylinder in-line engine as connected with extension shafting and gear reduction unit for use in the Curtiss P-75.

Twenty-Five Years of Transcontinental Flying

Of Men and Wings. A story of the 25 years of flying over the coast-to-coast route of United Air Lines. It begins with the initial flight of a converted de Havilland airplane of the first World War, loaded with air mail, and reviews the steady progress that has been made in the development of transcontinental flying from year to year up to the present. It discusses the improvements in aircraft and the growth in the company's fleet of transport planes, as well as the services of the company in the second World War. The final pages give an estimate of the future operations of the organization. *United Air Lines, Inc.*

Valves

Physically Fit to Shoulder Their Jobs for Winning the War. Superseding all previous issues, this is reference book No. 38 on Homestead products. It is composed of descriptive, price, and ordering information for various kinds of valves, including straightway, lubricated, lever-sealed, angle, three-way, four-way, hydraulically operating, and hydraulic spray types. Flange dimensions, suggested applications for the valves, and the quarter-turn principle underlying the design of the valves are covered in the booklet.

The two enclosures accompanying the valve information deal with the operation, applications, and specifications of a steam cleaner called the Hypressure Jenny. *Homestead Valve Manufacturing Company,* Coraopolis, Pa.

Automatic Machine-Tool Control

What Is Duplimatic and How Does It Work? An automatic machine-tool control is described and illustrated in a 16-page broadside. It is stated that this Duplimatic machine can turn one or two or three feed screws of any machine tool automatically. Screws are operated simultaneously, but independently of each other, to perform contouring work at high speeds and with great accuracy. *Detroit Universal Duplicator Company,* Detroit.

Solenoids for Aircraft Applications

Ledex Rotary Solenoids. A line of rotary solenoids, their operating principles, and their uses are described in a new 8-page brochure. Charts and drawings help to explain the utility and features of these solenoids. *George H. Leland,* Dayton, Ohio.

Air Pumps

New Motor Driven Dry Air Pump. Accessory Design Check Chart No. 17 tells about the application, performance, and design features of a motor-driven dry-air pump. It is illustrated by diagrams and drawings of the pump. *Eclipse-Pioneer Division, Bendix Aviation Corporation.*

Lighting-System Regulator

The Haug System Constant Current Regulator is described in a 4-page folder giving specifications and information about the operation of equipment for holding current constant in series lighting systems. The systems are used for lighting streets and highways and are particularly adapted for the illumination of airports and runways. *Modern Control Equipment Company,* Chicago.

Magnesium-Foundry Facilities

Tour of a Modern Magnesium Foundry is a booklet of 12 pages giving a brief description of the equipment and operation of a modern magnesium foundry. The facilities and equipment of each department are outlined briefly. The booklet is accompanied by technical information concerning magnesium alloys, their fabrication and properties. *Hills-McCanna Company,* Chicago.

Connector Plugs for Aircraft

Cannon Plugs for Aircraft Electrical Circuits is a revised edition of the bulletin on Cannon electric connectors. It contains 64 pages of information about type "K" and type "RK" plugs, receptacles, dust caps, junction shells, and stowage receptacles for aircraft and other instruments, radio, motors,

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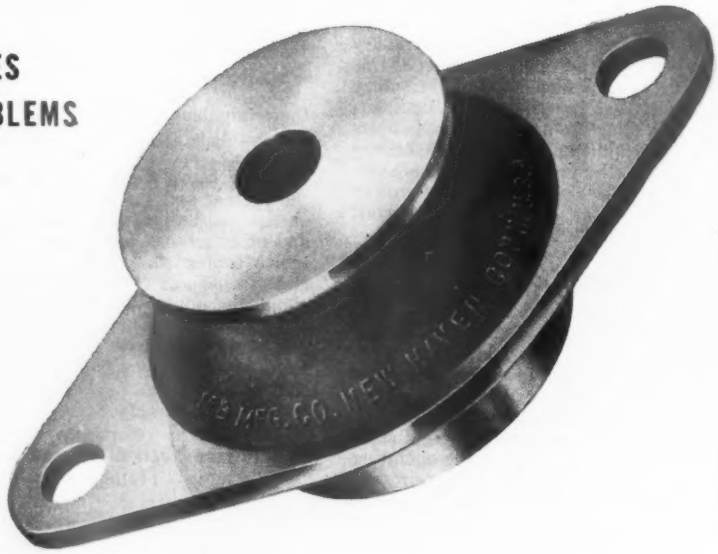

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Developed for both vibration detection and as an aid to its analysis, the MB Pickup features excellent response to very low amplitudes . . . exceptional durability under conditions of severe vibrations . . . negligible frictional effects . . . and calibration stability over broad temperature ranges. Output is proportional to vibratory velocity, with effective frequency range 5 to 1000 cps. The MB Pickup is usually operated as a seismic instrument, and is quickly converted for use in either horizontal or vertical plane without affecting calibration. Write for 4-page folder with full details and description.

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geophysical equipment, and general electrical applications. Detailed descriptions and specifications are given of a large number of these electrical connection devices, in text and tables, illustrated by photographs, exploded views, production illustrations, and pictures of applications. *Cannon Electric Development Company*, Los Angeles.

Aerial "Pickup" Equipment

Where Does Hy-Ten-Sl Bronze Fit Into This Picture? This 4-page folder gives information about a material designed especially for the hooks and other equipment used for air-cargo and air-mail "pickup" aircraft. It relates briefly why the manufacturer's bronze material is suitable for the requirements of such service. *American Manganese Bronze Company*, Philadelphia.

Data Book on Plastics

The Watertown Book of Plastics. An illustrated booklet of 44 pages gives descriptions of various plastic materials and the uses for which they are suited. The chemical and other properties of these materials are tabulated, and extensive information is given concerning the methods used in their production. Other sections refer to the uses of the material in varied industrial products. *The Watertown Manufacturing Company*, Watertown, Conn.

Training in Navigation

Precision Navigation Insures Safety in the Air and on the Seas. An 8-page leaflet reviews the facilities of the Institute of Navigation. It traces the history of the organization, outlines its purpose, and gives some information about the instruction offered. *Institute of Navigation, University of California*, Los Angeles.

Control Cabin

Front Office. Tom Potwin. Illustrated by drawings and photographs, the Stratocruiser's cockpit is described. The cabin of the C-97 is reported to be both roomy and functionally arranged. *Boeing Magazine*, October, 1945.

Plant Facilities

Views of Plants and Products are given in an illustrated booklet showing the facilities of a manufacturer of mechanical equipment now available for specialized engineering assignments. Exterior and interior views of the plants and of a number of the products that have been manufactured are included. This information is made available for organizations that may have need of specialized plant facilities and engineering experience.

Among the products illustrated are a gun turret manufactured for the B-17 bomber, gun-control mechanisms, counterrotating aircraft propellers, and two different types of aircraft engines. One of the engines featured is a 12-cylinder inverted, in-line gasoline aircraft engine, and another is the Michell crankless aircraft engine. Numerous other precision aircraft parts manufactured for the Army Air Forces are also featured. *The Steel Products Engineering Company*, Springfield, Ohio.

Machine-Tool Progress

Pioneers for 50 Years reviews the history of the Cleveland Pneumatic Tool Company and its contributions to the mechanical industries over a period of 50 years. Views of the interior of the plant in its early days show the contrast to the present factory layout, and other illustrations show present-day applications of the company's products. The text matter refers to the outstanding events of different periods in the history of industrial development in America. Many of these events are closely connected with the development of aviation. *The Cleveland Pneumatic Tool Company*, Cleveland.

Plant-Layout Planning Cards

Production Planning Data. Production-planning cards and data sheets for the use of industrial executives and engineers are offered for use in reconversion, in providing for expanded facilities, or in new building plans.

The cards and data sheets are designed to simplify the layout of production flow by providing scale machine models that can be placed on the factory floor plan and arranged to meet particular production or space requirements. A set of three cards is offered, referring to three different models. Each card reproduces eight to twelve plan views of the model, scaled $1/4$ in. to the foot, together with specifications of the machine. These plan views can be cut out of the card and used as individual units for planning efficient allocation of available space on the factory floor plan. *Plan-O-Mill Corporation*, Hazel Park, Mich.

Cellulose Acetate Processes

Hercules Cellulose Acetate. A revised edition of a technical reference booklet on cellulose acetate brings up to date the fundamental information given about the three major bases for cellulosic plastics. Included in the plastics section is a new chapter on the use of cellulose acetate in thermoplastic laminates. The improved dimensional stability and greater water resistance of plastics made from high acetyl acetate are also outlined.

Beginning with a description of the processes by which the acetate is manufactured, the booklet gives data about the general properties and specific properties that have made acetate useful in the plastic and related fields.

Part two is a discussion of specific uses of acetate in lacquers, film and foil, laminates, and plastics. Tables include data on properties of cellulose acetate, solvents useful with cellulose acetate, compatibility of resins with cellulose acetate, starting formulas for specialty lacquers, and properties of cellulose-acetate plastics and laminates. *Hercules Powder Company*, Wilmington, Del.

Radio Equipment Engineering Data

Bendix Radio Data Sheets. Specifications and descriptive details for Bendix aviation radio equipment are contained in three publications. A 4-page leaflet includes engineering information, illustrations, and mechanical data relative to the RA-2D communication receiver. *Bulletin No. SE-118* deals with the MI-32 interphone and isolation amplifier. Its specifications and installation instructions are supplemented by a simplified schematic diagram showing basic elements of isolation circuits and reamplifiers. The third publication, *Bulletin No. SE-117*, is pertinent to the design, installation, and operation of the MN-57A loop position transmitter. *Bendix Radio Division, Bendix Aviation Corporation.*

Phosphor Bronze Booklet

Technical Data, Elephant Brand Phosphor Bronze. Technical and descriptive information is given for phosphor-bronze products. Properties and uses considered are those of phosphor-bronze rods, sheet and strip, spring wire, welding wire, and wire ropes. *The Phosphor Bronze Smelting Company*, Philadelphia.

Shielded-Arc Phosphor Bronze Welding Electrode

Bulletin W-7 describes Phos-Trode, a shielded-arc phosphor-bronze welding electrode. Illustrated with views of typical welds and tests, this bulletin contains data about weld-deposit physical properties, recommended amperage, welding procedure, and a list of typical applications.

Some of the outstanding features claimed for the electrodes are low spatter loss, spray-type arc action, superior bead contour, dense deposits free from porosity, excellent physical properties, shielded-arc characteristics, and good manipulation with short arc. The electrodes are said to be suitable for d.c. welding on cast iron, malleable iron, steel, bronze, and brass. *Ampco Metal, Inc.*, Milwaukee.

From Vega to Black Widow

Northrop Airplanes. A group of photographs shows the airplanes designed and manufactured by Northrop Aircraft, Inc. With each of the full-page illustrations accompanied by a brief description of each successive plane, Northrop design development is traced from the Vega of 1927 to the P-61 Black Widow. An introductory list summarizes the company's major contributions to aviation. *Northrop Aircraft, Inc.*

Guide to Correct Aircraft-Engine Lubrication

Sinclair Recommendation Index for Aircraft Engines. This booklet is intended as a guide to correct lubrication of United States aircraft engines. It describes and identifies current engine models, specifying the proper grades of aircraft-engine oil to be used for each

...For Progress in Radio
Here are views of the just-completed Collins hangar at the Cedar Rapids Airport, and the company's 18S twin-engined Beechcraft. The installation is dedicated to constant advancement in the design and performance of radio communication and navigation equipment for aviation.
The wing to the right of the hangar contains laboratories for Collins physicists, engineers, technicians and mechanics engaged in specific projects that require much space and the use of the plane.
Customers of Collins equipment are invited to remember that these facilities are available for installation and service. The Cedar Rapids Municipal Airport, with its 5400 ft. runways, will accommodate the largest aircraft. Collins Radio Company, Cedar Rapids, Iowa; 11 West 42nd Street, New York 18, N. Y. In Canada Collins equipment is sold by Collins-Fisher Limited, Montreal.
COLLINS RADIO CO.-CR-IAT
IN RADIO COMMUNICATIONS, IT'S...
COLLINS

under tropical, summer, winter, and sub-zero conditions. Under octane rating, the charts also show the correct grade of fuel to be used for each engine. The complete line of the company's lubricants for the aviation industry are listed separately. *Sinclair Refining Company*, New York.

Light-Plane Radio Units

For Wider Horizons. In elementary terms, an illustrated booklet tells how radio communication increases the safety and utility of the light plane. The advice also serves as an introduction to some general details about Bendix radio equipment, including a radio receiver, a two-way radio telephone, a direction finder, and a portable receiver. *Bendix Radio Division, Bendix Aviation Corporation.*

Design and Installation of Push-Pull Controls

Handbook of Engineering Design Data on Simmonds Precision-Built Push-Pull Controls. Basic design and engineering information regarding particular installations of push-pull controls are contained in this handbook. Following a general introduction, comprehensive directions are given for planning the control layout. These are supplemented by plates showing design details and tables for the computation of the "minimum straight," as well as by an accessories section and parts list. A fifth section of the manual, referring to test data, imparts information relative to tests for static strength, endurance, efficiency, precision control, deformation, and resistance to corrosion. *Simmonds Aerocessories, Inc.*

Production and Maintenance Suggestions

Douglas Airview, August, 1945. (1) Punch press guide for hat-section angle is adaptable for Strippit Punch in alignment of holes on long angles, ensures accurate alignment and saves man-hours; (2) fixture to correct mislocated tooling holes at fuselage joining jig, bolts on at proper station and holds full contour of skin while holes are drilled; (3) new unit and method for testing autopilot servo saves time and eliminates need for removing the servo flight gyro and rotary inverter from plane for checking; (4) redesigned and reworked bomb-door hydraulic system sequence valve eliminates valve chatter; (5) new method of drilling holes in cowling flaps permits holes to be drilled without using castings and nutplates, also saves time; (6) unit for testing output of servo amplifier to the amplidyne field can be used in shop for testing and in actual operation as a trouble shooter; (7) a universal joint, attached to an air-powered vane motor, is used to raise and lower drill press in reaming torque tubes for elevator and rudder; (8) jig for drilling, riveting, and assembling a "Z" angle in subassembly saves considerable rework time and makes it possible to hold tolerances to 0.0005 in.; (9) improved method of trimming skin along longeron in the area of bomb-bay doors saves time; (10) method of arranging the parts of rear section panel and radius so that they can be installed by an Erco machine permits one operator to do the work that formerly required two; (11) the use of a removable plug on reversible pierce blank templates for making both right-and left-hand parts saves man-hours.

Republic Aviation News, September 14, 1945. (1) An effective skin trimming tool, particularly useful in trimming overlapping joints where clearance between skins is required; (2) an improved method for re-energizing loft luminous plates; (3) a design change on the bracket cable fastener for the cowl-latch cover. Breakage of the bracket is eliminated by substituting steel for alclad on the bracket cable fastener for the cowl-latch cover.

Allison News, September 20, 1945. (1) Incorporating solenoids in the hydraulic controls of Heald Borematics makes their action completely automatic and increases their efficiency and quality; (2) combining in one Borematic two operations formerly run on an engine lathe and rotary grinder results in a saving of time; (3) a special anode rack reduces refining costs.

I.A.S. Change of Address

The Institute of the Aeronautical Sciences, Inc., previously announced the purchase of the former E. J. Berwind residence in New York for its new headquarters. Alterations on the building are now being completed, and it is expected that the Institute will occupy these new quarters in January, 1946. All mail addressed to the Institute or its publications should, after January 1, 1946, be addressed to

2 EAST 64th STREET
NEW YORK 21, N. Y.

LIBRARY SERVICES TEMPORARILY SUSPENDED

The W. A. M. Burden Library, The Paul Kollsman Library, and the card and reference files of the Institute are now being moved. The packing, moving, and unpacking of 30,000 books and the moving of the extensive files are interrupting the services of the Library until they can be resumed in January in the new quarters. For this reason, the services of the Reading Room have been suspended, and mail or telephone inquiries and requests cannot receive immediate attention during the period of moving.

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Mallory Silver, Elkonium and Platinum Contacts and Assemblies for:
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Low Voltage Relays
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Thermostat Equipment
Low Voltage Meters and Gauges
Voltage Regulators
Automotive Light Switches
Motor Starting Relays

Mallory Elkonite Contacts and Contact Assemblies for:
Oil Circuit Breakers
Air Circuit Breakers
Industrial Controls
Heavy Duty Relays
Starting Switches
Voltage Tap Changers
Aircraft Relays
Heavy Arcing Equipment

*Reg. U. S. Pat. Off. for electric contacting elements.

From the Industry

Plastic Coating for Nacelles and Propellers

Corrosite, a practically impermeable air-drying film, is stated to be resistant to most acids, all alkalies, and many chemicals. The coating, a combined thermoplastic and thermosetting film, is expected to solve the maintenance problems created by deicing fluid, salt air, and salt water, to all of which it is reported to be impervious.

The manufacturer states that additional advantages are, first, that it will bond to practically any clean surface, including old paint; second, it offers greater abrasion resistance than can be achieved with other surfacing materials without the use of heat; third, it is electrolytically impervious: a three-coat application on any metal will eliminate deterioration caused by electrolytic corrosion. No prime or intermediate coats are required and, prior to application, no special or unusual surface preparation is needed. The clear material weighs 9 lbs. per gal. and covers up to 450 sq.ft. Successive coats can be applied with only 1 hour's drying time between them, permitting a three-coat application in a single day.

It is reported that the material will not crack, chip, or lift, and will withstand temperatures up to 250°F. It is currently available in black, clear, aluminum, and gray, in 5-gal. cans and 55-gal. drums. Baker Synthetics, Inc., New York.

Controllable-Pitch Propeller for Light Airplanes

A controllable-pitch propeller that incorporates the knowledge gained through 2 years' usage by the Army Air Forces is now being manufactured for civilian light airplanes. It is similar to those used on the Army's L-4J liaison (Grasshopper) airplanes during the war to improve their take-off and climb performance.

The smallest unit, known commercially as the R-000 series, is the one now on the market. This model is adapted to the Continental A-65 and C-75 engines and any similar engine equipped with a number O taper at the end of the crankshaft. The manufacturer states that in comparative tests the R-000 type has shown an increase in rate of climb and decrease in take-off run of 15 to 26 per cent for the various types of airplanes on which it was tested, in comparison with standard fixed-pitch propellers. This is the type that was used on the Grasshopper planes and carries C.A.A. Type Certificate No. 804.

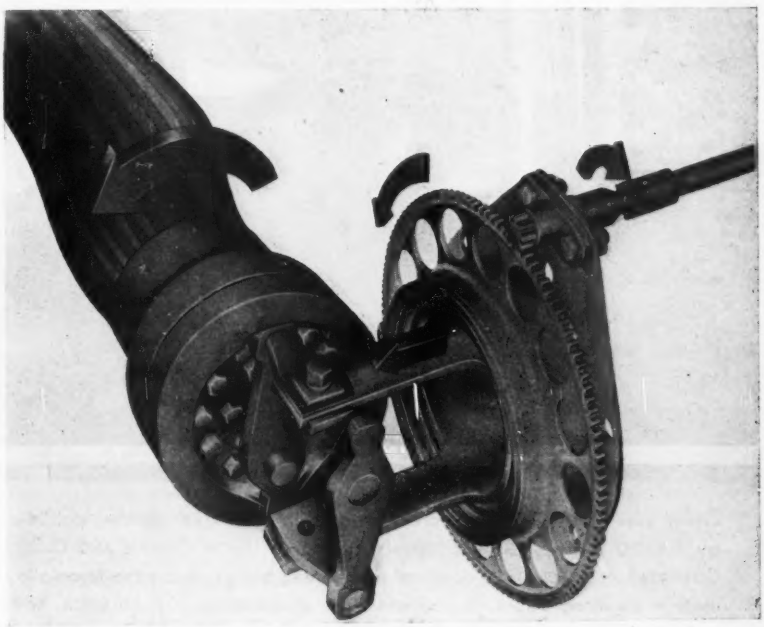
The second and larger unit is the R-200 series, for engines from 150 to 225 hp., having crankshafts with standard SAE 20-spline ends. This series has been tested on several of the postwar airplanes now in development, and also on the Grumman Widgeon, PT-19, and other planes. Take-off time from the water was reduced by Beech propellers on the Widgeon to 52.25 per cent of that required with fixed-pitch propellers, and the ground run required for take-off was reduced by 30.5 per cent. This unit is licensed under C.A.A. Type Certificate No. 807. Electric control and constant-speed governors will be available.

The pitch angle of the blades in the propeller is continuously variable, within the operating limits of each model, and is under control of the pilot at all times, by means of the manually or electrically controlled pitch-changing mechanism. A small hand crank on the instrument panel is utilized to change the pitch in the manually controlled models and is easy to operate, when the engine is either running or stopped.

On planes equipped with the proper type crankshafts, it is necessary merely to bolt the pitch-changing mechanism to the front of the engine at the time the propeller is fastened to the crankshaft. Any convenient point where a reasonably straight drive to the pitch-changing gear is available will serve as a location for the electric pitch-changing control.

No lubrication of the pitch-changing gear is necessary since it does not turn except while the pitch is being changed, and the setting is always the same for any given pitch position. The constant-speed governor actuates the electric pitch-control mechanism. This permits its installation at the usual governor-drive position on any engine, with a simple wiring harness connecting the governor to the electric pitch-control mechanism and to the actuating controls in the cockpit. Converting a manually-controlled propeller to electric or constant-speed control is possible by a comparatively simple modification.

Weight of the R-000 propeller when equipped with manual control is about 30 lbs. when installed. Weight of the R-200 series propeller varies considerably, depending on the length of the blades, which to date have been made from 73- to 96-in. disc diameter. Including the electric or constant-speed control mechanisms, the installed weight of these propellers will be from 60 to 75 lbs. Beech Aircraft Corporation.



The mechanism of Beech Aircraft Corporation's new controllable-pitch propeller for light airplanes.

Bake in a Hot Oven . . . 1,950°F.

These red hot "cakes" are partially drawn stainless steel kettles that have just been annealed prior to further deep drawing. Strong, corrosion-resistant, and easy to clean, the kettles are of the type used extensively in hospitals, restaurants, and other institutional kitchens.

The ease with which stainless steel can be fabricated by the usual shop methods—such as casting, deep drawing, and welding—is one of the many reasons why it is so often specified where there is a need for equipment that is strong, tough, and has good resistance to rust and corrosion.

Other uses of stainless steel are described in ELECTROMET REVIEW, published by ELECTRO METALLURGICAL COMPANY, a Unit of UNION CARBIDE AND CARBON CORPORATION. ELECTROMET does not make steel, but produces the ferro-alloys used in its manufacture. If you need this complimentary publication, write to ELECTRO METALLURGICAL COMPANY, 30 East 42nd Street, New York 17, N. Y.

Buy and Hold United States Victory Bonds and Stamps

New "Tele-Flight" Aid for Private Flying

A new "tele-flight" machine is designed to give realistic "flight training" on the ground. Patterned after training equipment employed by the Army and Navy air forces, "tele-flight" includes a complete light-plane cockpit with standard aircraft seats, instrument panel with new radio equipment installed, and control wheels. Through the cockpit windshield the student pilot sees projected on a screen the same scenes he would see if he were actually taking off in flying and landing a light personal plane. Bendix Aviation Corporation.

Vibration-Absorbing Levelers

Low-cost rubber-insulated, dual-purpose machinery mountings for absorbing vibration from machinery of any size, type, or weight, have a means for leveling the machinery. The new mountings, known as Vibro-Levelers and manufactured in nine sizes ranging in load capacities of from 10 lbs. to 2,000 lbs. each, are for use on such noise- and vibration-producing equipment as punch presses, compressors, blowers, forging hammers, grinders, buffers, etc.

Designed to be installed quickly with no floor cutting or fitting, they are for use on either new or existing equipment. Brackets, available in various capacities, permit installation of the mountings without materially raising the elevation of the machine. Being of synthetic rubber, the insulating material employed is not liable to attack by oils or greases and thus can be used under virtually any conditions.

The mountings are simple in design and construction, and once installed require no oiling, greasing, or other maintenance attention. The synthetic-rubber insulating material separates an outer shell, which also forms the base of the mounting, from an inner cylindric member, to which is fastened a single stud. Leveling is accomplished by means of two nuts supplied with each mounting; one nut is for adjusting the machine to the exact level desired; the other, for locking it in the leveled position.

When used to support new equipment where the operating height is not important, the mountings are usually placed directly under the base of machine. Where the machinery is already installed and the height must be maintained at approximately the same level, standard brackets are available so that the mountings can be installed without cutting the floor.

Standard brackets are of two types, zee and angle. The zee brackets are for attaching to the existing hold-down bolt holes in the base of the machine and require no cutting or welding to attach to the machine. The angle brackets are for mounting to the side of the machine base either with bolts or by arc welding.

Although available in sets of four, the machinery mountings can be used in any number required for various machines, so that machinery of virtually any size or weight can be insulated and leveled. Bushings, Inc., Royal Oak, Mich.

Releases are printed as received from companies and other aeronautical organizations and the responsibility for the accuracy of all statements is therefore not assumed by the Aeronautical Engineering Review.

Improved Pressurized Connector Receptacles

To meet the demands of higher-altitude flying where pressurized cabins are required and for many other uses, improved pressurized receptacles in both Cannon "AN" and "K" standard connector types are now available, and in "AN" sizes from 12S to 44 inclusive. Inserts are "spun-in" to the shell with a special sealing washer. However, the arrangements are limited to those carrying numbers 20, 16, or 12 small contacts at the present time.

Air-leakage pressure tests for these fittings conform to Sec. F-6n of the Army-Navy Specifications AN-W-C-59lb, dated March, 1945. The pressurized receptacle is subjected to a pressure differential equivalent to 30 lbs. per sq.in. for a period of 1 hour at a constant temperature and must likewise be tested under water. In the thermocycle tests at the same maximum of 30 lbs. per sq.in., several cycles of temperature are given, ranging from −67° to +185°F. Cannon Electric Development Company, Los Angeles.

Carbide "Edge" Facilitates Hardness Test on Threads of Nuts

A new application of the use of cemented carbides in the field of hardness testing has recently been developed by Pratt & Whitney Aircraft Division of United Aircraft Corporation. For a number of years solid Carboloy balls have been used in Brinell machines, particularly for checking hardness in higher ranges. For this purpose, the extreme hardness of cemented carbides has insured greater accuracy of hardness determinations.

In the Pratt & Whitney Aircraft application, the use of Carboloy cemented carbide has made possible the checking of comparative hardness inside small bores. The actual application is the checking of hardness of threads in castellated aircraft engine nuts. The carbide is in the form of an "edge" penetrator mounted in a C-extension arm on a Rockwell machine.

The Carboloy penetrator has an obtuse angle with a 0.010-in. radius at the edge. The modified "C"-shaped steel holder is attached to the Rockwell machine. This arrangement enables the carbide "edge" to contact the internal threads of the nuts being checked. Conventional Rockwell scales, such as the B or C scales, cannot be used. Carboloy Company, Inc., Detroit.

Counterbore Spot Facers

Sets of four adjustable counterbore spot facers are designed to cut any fractional or decimal diameter within a range of $^1/_4$-in. to $1^3/_8$-in. outside diameter. Each one is adjustable to a wide range of sizes: Model No. 43B-H has a cutting range from 1-in. to $1^3/_8$-in. outside diameter; No. 42B-H from $^3/_4$-in. to 1-in.; No. 41B-H from $^9/_{16}$-in. to $^3/_4$-in.; and No. 40H cuts from $^1/_4$-in. to $^9/_{16}$-in. outside diameter.

Holes may be counterbored to any depth. A cross-lip or shoulder is intended to prevent burrs from forming around the edge of the pilot hole and eliminate galling and binding. Pilots are hardened and ground. High-speed steel blades can be quickly sharpened or replaced and are always obtainable from mill-supply distributors.

The set, designated as No. CS-1H, contains, in addition to four counterbores, an assortment of eleven extra pilots, all mounted in a wood crib box. Cast-alloy blades are available for all counterbore sizes. Robert H. Clark Company, Beverly Hills, Calif.

Portable Megohm Meter

Stability, portability, and a range from 400,000 ohms to 100,000 megohms in five ranges on a single-scale 4-in. dial are among the features of the new Model 1500 Megohm meter. This unit also offers protection against atmospheric conditions where precise testing is required. Accuracy is stated to be within 5 per cent at any position on all ranges.

Weighing only 8 lbs., the Model 1500 may be employed in laboratories or on production lines where it is necessary to measure and test in separated locations, in a wide range of applications, such as measuring of leakage resistance of insulation materials, condensers, coaxial cables, wiring harness, and at motor and transformer windings. On production checking of resistors the range may be extended by the increment method. The instrument is also recommended by the maker for determination of moisture content of wood, paperboard, plastics, textiles, and many other materials in which electrical resistance is a function of moisture content.

The Model 1500 is reported to be stable despite line-voltage fluctuations. A change in line voltage from 90 to 130 volts produces a change of less than 3 per cent in meter reading at mid-scale. Single zero-reset adjustment is provided for all ranges, and drift after initial warm-up period is substantially zero. The instrument operates on power of 115 volts, 60 cycles. Communication Measurements Laboratory, New York.

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Accessible Gasoline Strainer

The Consolidair gascolator bowl is designed to fit all light planes. With the device it is no longer necessary to remove both cowling and bowl, because an adapter extends from the base of the bowl to a safety-type valve that is flush with the outside of the cowl. The manufacturer states that draining can be accomplished quickly and easily, giving no chance for dirt or sediment to reach the carburetor and engine. Consolidair, Inc., Alliance, Ohio.

The Culver Model "V"

The new Culver Model "V" personal airplane is reported to be chiefly a refinement and further development of preceding Army, Navy, and commercial Culver models. It features externally stressed skin and wood construction; electrically retractable tricycle gear, with the Mooney power unit with auxiliary manual operation provided; an antistall characteristic inherently built into the airplane and intended to eliminate the possibility of spins; simplified control entailing the basic interconnection of wing flaps with the stabilizer, together with a flight-control dial indicating to the pilot the optimum settings to obtain the best performance of the airplane; cruising range in excess of 700 miles; and a pay load allowing 80 lbs. of baggage and 35 gal. of gasoline, in addition to pilot, passenger, oil, parachutes, and essential flying instruments.

The Model "V" also incorporates a newly developed nylon and rubber gasoline tank that allows the gasoline to be carried in the leading edge of the wing without damage to the tanks through deflection of the wing, and is designed to ensure a minimum of change in trim as a result of use of gasoline from the two tanks; a Continental fuel-injection engine of 85 hp.; full flaps; factory built-in provision for two-way radio; individually adjustable Airfoam seats; larger wheels; larger and wider de luxe soundproof cabin. Culver Aircraft Corporation.

Grinder-Coolant Filter

The Coolant-Klean, a new filter for cleaning grinder coolant and similar solid-bearing fluids, is intended to effect savings in filter cost, maintenance, and replacement. It has a replaceable, bag-type filter element mounted on a screen spacer so as to provide a filtering area of 1,000 sq.in. for full flow.

Experience is reported to show that extremely fine grinding finishes are obtained over a longer period of time—often extending up to 6 weeks—without replacing the element. When replacement of the bag is necessary, this is accomplished in less than 5 min. Loosening a single screw clamp opens the filter; the soiled element is discarded, and the accumulated grit emptied from the sump. A clean bag is easily installed.

The filter can be applied to any type of grinder and is also adaptable to al-

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30th Year

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most any machine using a coolant or cutting oil. No alteration of the grinder is necessary. Installation of the complete unit between the grinder pump and the work nozzle averages about 15 min. Only two flexible-hose connections are necessary. No extra pump, electrical work, plumbing, valves, or by-passes are required. Cuno Engineering Corporation, Meriden, Conn.

Supersonic-Flight Progress

Speeds in excess of 1,400 m.p.h. are reported to have been achieved by special flying devices built by the Curtiss-Wright Airplane Division Research Laboratory, in cooperation with other organizations. While details of the project are not disclosed, it is stated that Curtiss-Wright research engineers are also studying improved air-conditioning methods occasioned by the heating effect of air friction on the skin of the plane during high-speed flying.

As an example of action toward solution of high-speed problems, a leading edge of a wing is equipped with a stainless-steel sheathing to combat abrasion. The interior construction is aluminum alloy reinforced by three layers of plywood to provide greater stiffness and strength. It is also revealed that the cone of a nose section has been constructed of Fiberglas and plastic to resist shock waves and also permit radar equipment to be housed wholly within the airplane, thus reducing aerodynamic drag. In the past, part of the radar apparatus has been installed on the outside of the airplane to overcome disturbances caused by the metal construction.

One of the laboratory's latest achievements is a telemetering system whereby the performance data of an object in flight is recorded and studied at a mobile receiving unit while the flight is in progress. This system is being used in some of the experimental studies of high-speed flight. In addition, images of the instrument panel are transmitted by television from the object in flight to the research engineers on the ground for an up-to-the-minute view of the test flight. Curtiss-Wright Corporation, Airplane Division.

Pyroxylin Lacquer

Specially developed pyroxylin lacquer is used on the surfaces of the Navy's new Ryan FR-1 Fireball fighter plane, to provide the top-coat flexibility needed to withstand vibration at extremely low temperatures. It is similar to the finish provided for the Army's P-80 Shooting Star. A special thinner had to be evolved to allow the fast-drying lacquer to flow out to a smooth film, thereby minimizing compounding.

Aircraft-type putty is used to fill surface imperfections on the leading edge of the wings. A zinc chromate primer is applied to help protect the metal from corrosion. Over this a liberal coat of surfacer is applied and sanded, followed by the top coat, which is polished to glass-like smoothness through the use of rubbing compound and spray wax. E. I. du Pont de Nemours & Company, Inc.

Eccentric-Sleeve Expanding Mandrel

A precision expanding mandrel with eccentric sleeve is stated to be able to hold the total tolerance of eccentric parts to be ground or machined to 0.0005 in. or less. With this mandrel eccentric parts can be turned or finished in a concentric plane with the same tools and equipment used for concentric parts, such as bushings or bearings, eliminating the cost of building special arbors for every diameter or taper required. All that is required with the mandrel is a special sleeve. The shank is standard.

Designed to operate on the same principles of expansion or contraction utilized in the manufacturer's standard precision expanding mandrel or collet chuck, this new mandrel is reported to have effected large savings in handling time through its self-releasing features, which eliminate the use of arbor presses or other methods to release the work. The sleeve collapses the moment the nut is released. The danger of injury to highly finished internal surfaces is claimed to be eliminated since the workpiece need not be forced onto the sleeve, the sleeve expanding up to the required inside diameter of the part.

Principles accounting for the high degree of accuracy guaranteed by the maker in this new mandrel are based on a mating within 0.0001 in. of cam surfaces of both shank and sleeve, permitting equal expansion of the open-slotted sleeve throughout its entire length. Interchangeable sleeves are available so that one shank only is suitable for any range of sleeves purchased. All Erickson mandrels, including this new one, can be adapted to air or hydraulic operation and to draw-bar or cantilever lock-nut types. Erickson Tools Division of Erickson Steel Company, Cleveland.

Technifilm for Technical Training

An important advance in technical training of engineering draftsmen and apprentices has been made by a new method of visual education introduced by the Fairey Aviation Company, Ltd. The new method uses the camera to present for visual study a complete range of engineering practice.

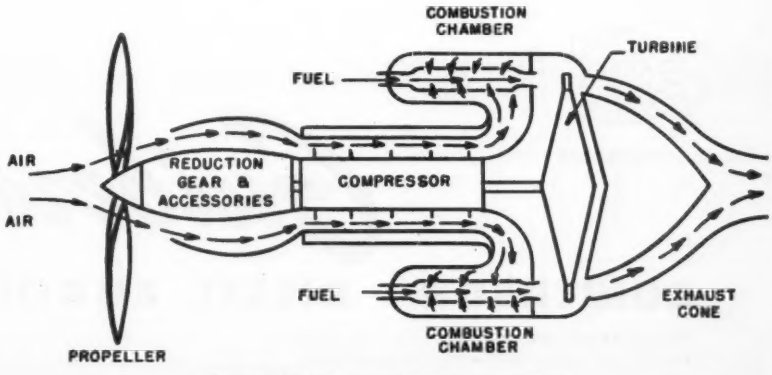
The Fairey Technifilm is made in seven reels and shows under factory working conditions more than 90 short shots of the principal processes in engineering. It attempts to display the whole range of shop practice; examples taken at random are a view of a drop hammer producing double-curvature shapes, a tank being seam welded, a helical spline being broached, and a jig borer being set up and operated. By selecting the operations it is desired to study, the Technifilm offers a visual engineering reference library. Any particular operation can be projected for the student at the time when he is faced with a problem involving that operation.

The new Technifilm is believed to be the only one of its kind made in Britain. It was not made as a "talkie" because experience shows that the instructor loses the influence of his own voice and personality over his students when his tutorial functions are taken over by an "outside" voice. Even for a short sequence, it has been found more efficient to have the instructor describe what is happening on the screen. As the film is expected to be shown throughout the world, foreign-language instructors will be able to give their own particular interpretation of the sequences with a minimum of trouble and expense.

The engineering Technifilm has two applications: it can assist materially in the rapid instruction of beginning students in engineering, and it can be used to correct a wrong approach to design by advanced students and draftsmen who unwittingly have fallen into inefficient ways. The use of the film can be directed toward correcting design errors deriving from failure to understand the implications of manufacturing and fabricating processes. Fairey Aviation Company, Ltd., Hayes, Middlesex, England.

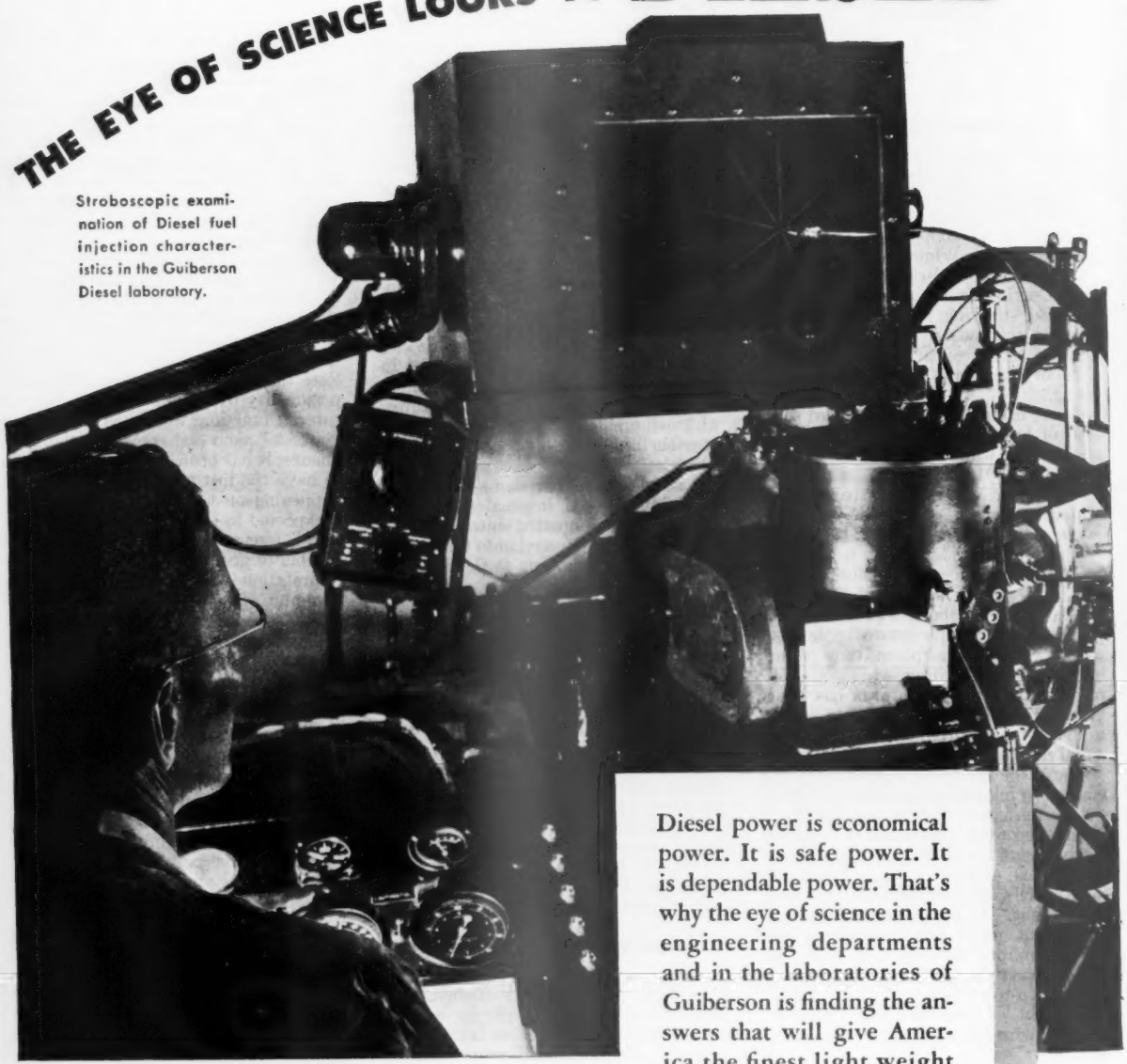
Power Plant Drives Propeller and Boosts with Jet Propulsion

The G-E Propjet airplane power plant gives two-way utilization of gas-turbine force to drive a propeller and boost the power with jet thrust simultaneously.



General Electric propeller-drive gas turbine.

THE EYE OF SCIENCE LOOKS TO DIESEL



Stroboscopic examination of Diesel fuel injection characteristics in the Guiberson Diesel laboratory.

Diesel power is economical power. It is safe power. It is dependable power. That's why the eye of science in the engineering departments and in the laboratories of Guiberson is finding the answers that will give America the finest light weight Diesel engine.

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GUIBERSON DIESEL ENGINE COMPANY

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DALLAS, TEXAS

Designed primarily to drive large, high-speed military transports and bombers, this unit has been subjected to rigid test-stand runs and in June, 1945, was installed in an experimental Army Air Forces plane of advanced design.

The gas turbine with propeller is designed for installation in the wings of multiengined aircraft or in the nose of a single-engined plane. Air that rams into the nose through ducts opening forward is compressed by axial flow units in the forward part of the engine and then is forced into the combustion chambers. The turbine powers the compressor and drives the propeller through reduction gears. Reactive thrust, created by the energy remaining in the gases after passing through the turbine wheel and discharging through the exhaust cone rearward, is utilized as in jet propulsion. General Electric Company.

A.C. Auxiliary Power Units for Aircraft

An alternating-current system to supply the electrical auxiliary power for the operation of radios, landing gear, lights, navigation instruments, and other control devices of large aircraft has been developed by General Electric Company in cooperation with the U.S. Army and the Sundstrand Company, of Rockford, Ill. Each unit electric power plant consists of an airplane-type engine, variable-ratio drive, and generator. The variable-ratio drive was necessary so that the generator would run at a constant speed and enable a parallel system to be used. Such a system is stated to increase flexibility and dependability.

The Sundstrand Machine Tool Company developed the variable-ratio drive and the General Electric Company supplied a governor with a high speed of response to control the drive so that regardless of the input speed to the drive, the generator speed remains constant. General Electric Company.

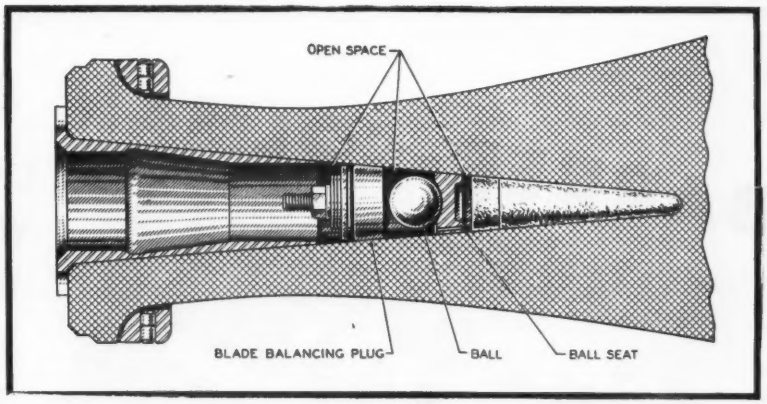
Deicer Installation Tool

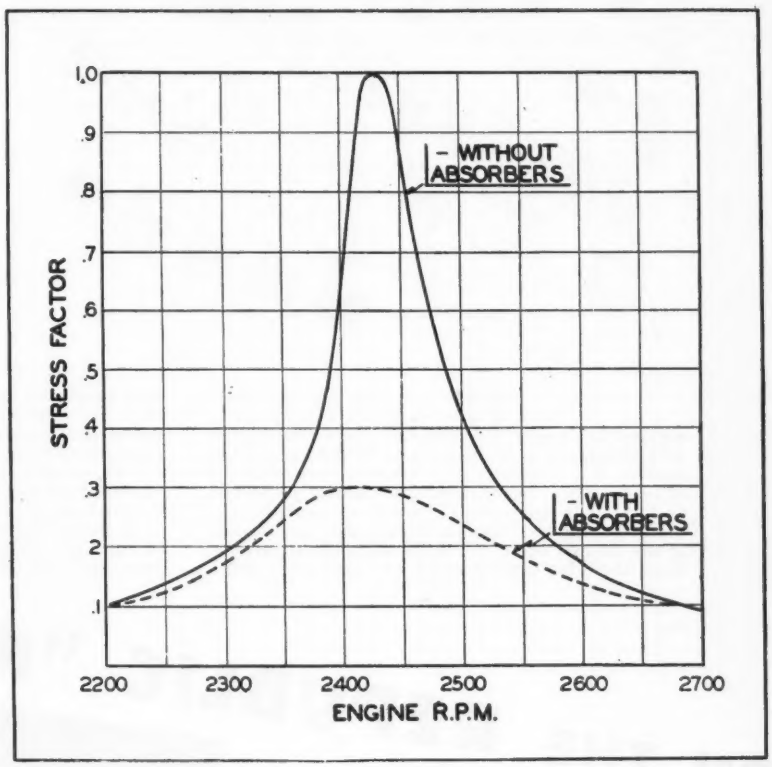
A hand tool firmly grips and holds the bead of the Goodrich rubber deicer while it is being pulled into place over the installation studs. A series of toggles is actuated by the lever of the new tool and provides a positive grip to the clamping jaw as it is placed over the deicer bead. The B. F. Goodrich Company.

Rivnuts Now Made of Steel

The Rivnut, a one-piece internally threaded and counterbored tubular rivet, is now being made in steel. Originally made only in aluminum and later also in a brass alloy, the adoption of steel will allow much greater utilization of the product, the company believes. The aluminum Rivnut was initially used for airplane applications but the field has been broadened to include many other services.

The new standard steel Rivnuts are made in 6-32, 8-32, 10-32, 12-24, 1/4-in.-20, and 5/16-in.-18 thread. They can be made in special sizes on order. An additional head style, the brazier head, also is being introduced. The B. F. Goodrich Company.





Photograph Courtesy Hamilton Standard Propellers Division of United Aircraft Corporation

By the use of a steel ball in the hollow shank of a propeller blade (*top*), vibrational stresses in the blade are reduced.

Controls Propeller-Blade Vibrations

Increased performance for several fighter and bomber-type aircraft is claimed for a device that controls propeller-blade vibrations set up by engine-firing action in flight. Consisting of a solid steel ball weighing less than 8 oz. and a socket seat, the development is said to reduce vibration stresses to less than half of their former intensity.

As a result of the new device, certain efficient propeller-blade types have been made suitable for use with engines of greater horsepower. Aircraft equipped with it include two of the Navy's fighter planes, the Grumman F6F Hellcat and Chance Vought F4U Corsair, and the Consolidated PB4Y-2 Privateer search-bomber.

The steel ball is smaller in diameter than the socket in which it rests, thus permitting it to rock back and forth, and is "tuned" in accordance with the vibrations of the particular installation. When inserted into the hollow shank of a propeller blade with its steel seat, it is held in position in flight by centrifugal

BARBER-COLMAN CONTROLS

CABIN TEMPERATURE
WING ANTI-ICING
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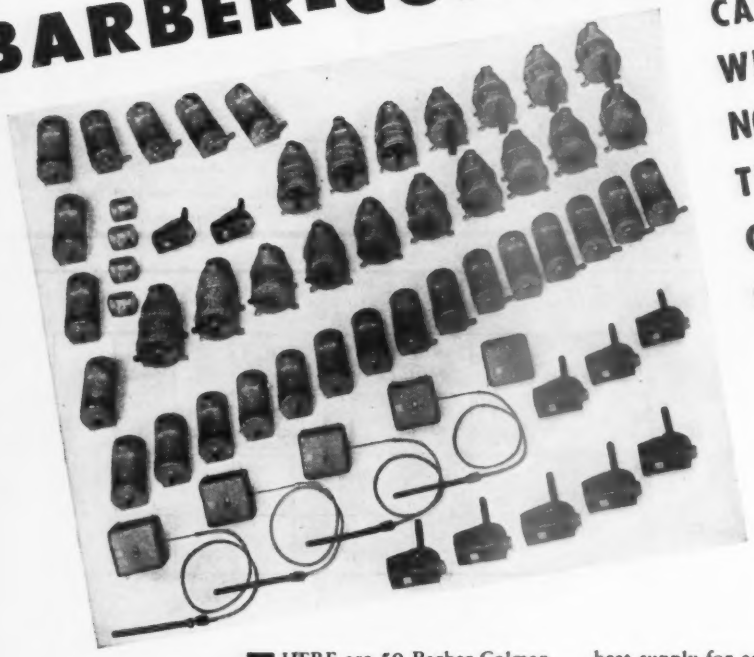
TURBO SUPERCHARGERS
CABIN PRESSURE
CARBURETOR FILTERS



THERE are 59 Barber-Colman automatic control instruments on Republic's new "RAINBOW" — 15 Thermostats of 3 different types, 40 Control Motors of various models, and 4 Micropositioners (sensitive polarized relays). They are grouped into several individual and carefully engineered systems to provide: (1) uniform cabin temperature, automatically maintained at the desired level; (2) automatic heat supply for wing anti-icing when needed (3) similar automatic heat supply for anti-icing of the nose cone; (4) remote power control at the turbo superchargers; (5) automatically maintained uniform cabin atmospheric pressure held constant regardless of altitude of flight; and (6) remote power control of carburetor filters, an important war-proved protection for the engines. Barber-Colman equipment, successfully applied in many famous fighting airplanes, is especially designed for light weight, high strength, accuracy, sensitivity, and dependable operation.

ON THE REPUBLIC "RAINBOW"

WORLD'S FASTEST TRANSPORT PLANE, WHICH WILL CRUISE AT 400 MILES PER HOUR, CARRYING PASSENGERS IN LUXURY ACCOMMODATIONS, A CREW OF SEVEN, MAIL, AND OTHER CARGO.

LOOK FOR BARBER-COLMAN CONTROLS ON THE LEADING LUXURY AIRLINERS

BARBER-COLMAN COMPANY
1245 ROCK STREET • ROCKFORD, ILLINOIS

force and on the ground by a plug that retains the ball in the blade.

Vibrations set up in the blade by firing action of the engine cause a response of the ball, which rocks back and forth at increasing speed as the engine speed increases. This rocking motion sets up forces that oppose the vibration and exert pressure directly through the ball seat to the sides of the blade.

In operation the ball moves a total distance of less than $^1/_8$ in. back and forth at speeds up to 230 times per sec. Wider applications of the vibration absorber, it is hoped, will make it possible to effect reductions in propeller weight. Hamilton Standard Propellers Division, United Aircraft Corporation.

Transmitter and Receiver for Personal Aircraft

The Harvey-Wells ATR-3 Transceiver for personal planes is a lightweight, compact, and sensitive transmitter-receiver unit designed to serve as a means of radio communication from plane to ground and ground to plane, as a direction finder to insure navigational safety, and for broadcast entertainment.

Purely functional in design, the ATR-3 weighs $12^3/_4$ lbs., measures $4^1/_2$ in. high by $5^1/_2$ in. wide by 8 in. deep, and will operate on a 6- or 12-volt synchronous vibrator power supply. The manufacturer reports that the unit has undergone a series of rigorous tests in the Tenney Stratosphere Chamber, simulating altitudes in excess of those gained by private fliers, and ranges of temperature and humidity not encountered under normal operating conditions. In addition, the ATR-3 has met vibration tests under varying frequencies and positions on the L.A.B. Vibration Apparatus.

Standard equipment includes tubes, crystal, headset, and aircraft microphone. Available equipment consists of loud-speaker, loop-antenna system, and trailing antenna with reel. Harvey-Wells Electronics, Inc., Southbridge, Mass.

Battery-Charge Indicator

The newly developed Hickok Chargicator indicates electrically the equivalent specific gravity of the electrolyte in a lead-acid storage battery. At the time of reading the battery need not be disturbed. It is designed to permit sensitive measurements, whether permanently connected to the battery or used as a portable tester.

The probe-type indicator gives instantaneous measurement of battery condition in percentage of full charge. It shows what charging rate to use, either for trickle charging or for a high-rate charge, and warns instantly of destructive overcharging. Weak or defective cells are readily detected before actual failure occurs, and the instrument may also be used as a check against future failure by using it in conjunction with a load test. Hickok Electrical Instrument Company, Cleveland.

Heat-Resisting Steel for Gas Turbines

Jessop G.18B steel is an austenitic heat-resisting steel developed primarily for rotor discs, turbine blades, and nozzles for gas turbines in jet-propulsion units. Over certain ranges of temperatures it possesses properties superior to other commercially available heat-resisting alloys, and has been used in particular for practically all the high-temperature gas-turbine rotors so far manufactured in Great Britain. The manufacturers state that the material was used in the gas turbines of the Gloster Meteor, which recently established what is believed to be a world speed record.

A report has been made of research work showing comparisons of the properties of this steel with the manufacturer's H.18 Silchrome valve steel (British En 52); R.16, 18 per cent chromium, 8 per cent nickel type stabilized with titanium; G.2, austenitic exhaust-valve steel (British specification DTD.49B); and with mild steel.

Figures are given for the properties of the G.18B steel in the standard heat-treated condition and by comparison with the foregoing materials. For certain purposes this heat-treatment can be modified to give higher properties at room temperatures, and in some cases higher properties at elevated temperatures. Tables show that the steel will withstand stresses at rates in inverse proportion to the temperature, the hot tensile tests ranging from 70°F. with maximum stress of 110,000 lbs. per sq.in. and elongation of 72 per cent, to a temperature of 1,600°F. with maximum stress of 40,000 lbs. per sq.in. and elongation of 10 per cent. Creep-strength tests of stress for 0.5 per cent strain in 300 hours range from 41,000 lbs. per sq.in. at 1,100°F. to 11,000 lbs. per sq.in. at 1,500°F. These and other figures refer to relatively high rates of deformation in comparatively short times, these being typical figures required for aircraft-engine practice.

For certain other design purposes it is usual to base the figures on longer life and comparatively lower rates of stress, and when subjected to such lower stresses the steel shows a comparable degree of superiority over other materials. For example, stresses to give a rate of creep of one-millionth of an inch per inch per hour show that G.18B steel has a given creep rate under stress of 34,000 lbs. per sq.in. at 1,100°F. compared with 18,000 lbs. for the G.2 steel, 15,000 lbs. for the R.16 steel and 2,300 lbs. for the H.18 steel or the mild steel. At 1,500°F. the given creep stress rate for the G.18B is 8,000 lbs. per sq.in., compared with 4,000 lbs. for the G.2 and 2,100 lbs. for the R.16. In a similar manner, other tests show the superiority of the material under rupturing stresses, in modulus of elasticity, coefficient of linear thermal expansion, and other properties.

Comparisons of standard material and aged material reveal that the aging treatment has the effect of raising the proof stress at room temperatures by an appreciable amount. Aging also has the effect of lowering somewhat the creep strength at elevated temperatures. William Jessop & Sons Limited, Sheffield, England. (William Jessop & Sons, Inc., New York).

Lower-Priced Instruments for Private Planes

Kollsman Instrument Division of Square D Company has developed a group of lower-priced, high-quality aerial-navigation and engine-control instruments intended to broaden the operational possibilities for the private pilot. The new instruments, to be known as Kollsman Scout, supplement the precision instruments manufactured for the Army and Navy and commercial air lines and, although similar in appearance and construction to the senior line, they will reduce, by almost one-half, the investment in instruments required for safe flying under virtually all conditions a private pilot will encounter.

Included in the Scout line are standard altimeters, sensitive altimeters, airspeed indicators, large and small compasses, and vertical speed or climb indicators. Kollsman is also bringing out two low-priced engine instruments, these being manifold-pressure gages and tachometers.

By applying the experience of 5 years of volume production of precision flight instruments for the Army, Navy, and air lines, and by eliminating the performance requirements of the military and commercial air lines at the extremely high and low temperatures to which the personal plane will not be subjected, it has been possible to develop rugged, dependable instruments that will give to the private pilot the safety that is essential if private aviation is to advance at the pace now believed possible. The instruments and their specifications are as follows:

Altimeter (standard): Range 0-20,000 ft., single pointer, one revolution per 10,000 ft., stationary dial, settable pointer, and barometric-setting subdial (inches of mercury); fits AN standard $3^1/_8$-in. mounting hole; weight approximately $11^1/_2$ oz.; case depth approximately 3 in.; provision for static connection in rear of case.

Altimeter (sensitive): Range 0-20,000 ft., two pointers, one revolution of long pointer for each 1,000 ft., 20-ft. graduations, settable pointers and barometric-setting subdial of range 28-31 in. of mercury; fits AN standard $3^1/_8$-in. mounting hole with cutout for center setting knob; weight approximately 20 oz.; case depth approximately $3^7/_8$ in.; provision for static connection in rear of case.

Air-speed indicator: Standard type, stationary dial; fits AN standard $3^1/_8$-in. mounting hole; weight approximately 8 oz.; case depth approximately $1^{15}/_{16}$ in.; provision for pitot and static connections in rear of case; ranges 30–160 m.p.h., 30–200 m.p.h., or 30–250 m.p.h.

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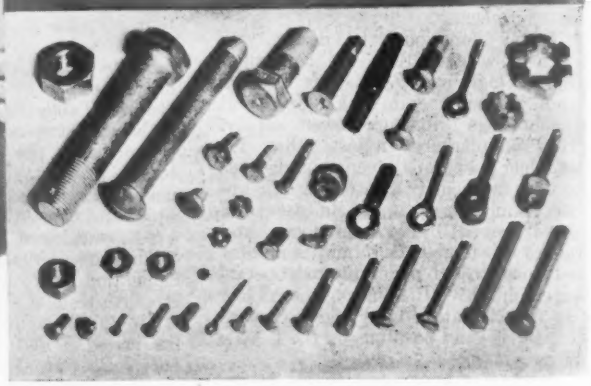

National
HEADED AND THREADED
PRODUCTS

During the war we have produced the most complete line of *aircraft fasteners* made by one manufacturer, and we are going to stay in that business.

For some time to come, the great bulk of aircraft fasteners used will be supplied out of surplus, but there are bound to be shortages of certain parts. We shall be prepared to supply these.

In addition to standard AN and NAS parts, National Aviation Products include many special parts, such as carburetor studs, motor mounting bolts, stainless steel instrument screws, dome nuts and many others.

National was officially recognized by the Air Forces for its "Quality Control". We shall continue to maintain the high standards that have made us a principal source for aircraft fasteners.

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

Compass (small): Standard floating-card type compass fits AN small $2^1/_4$-in. standard-size mounting hole; north-south and east-west compensating screws are accessible from front of instrument; unlighted; weight 9 oz.; case depth $2^7/_{16}$ in.

Compass (large): Standard floating-card type compass fits AN $3^1/_8$-in. standard-size mounting holes; compensating screws accessible from front of instrument; unlighted; weight 15 oz.; case depth $3^9/_{16}$ in.

Vertical speed (climb) indicator: Range 0–2,000 ft. per min. up and down, fits AN standard $3^1/_8$-in. mounting holes, with provision for zero-adjustment screw flange; logarithmic scale gives widely spaced graduations near level-flight point and closer graduations near limits of scale; compensated for effects of temperature on mechanism but without altitude and temperature compensation or thermal insulation (bottle); weight approximately 17 oz.; case depth approximately $3^7/_8$ in.

Manifold-pressure gage: Range 10–50 in. of mercury, standard single pointer; fits AN $3^1/_8$-in. standard-size mounting holes; weight approximately $11^1/_2$ oz.; case depth approximately $2^{27}/_{32}$ in.; mechanism compensated for effects of temperature changes; $^1/_8$-in. female pipe thread outlet in rear of case for connection to engine manifold. Radium-treated pointers, numerals and main graduations of these instruments also react to fluorescent light.

The manufacturer has in process of development fuel-pressure gages, oil-pressure gages, thermometers, and engine-gage units for augmenting the Scout Line. Kollsman Instrument Division of Square D Company.

Rotary Actuator

The new Model 181 Lear Rotary Actuator is designed to meet a growing demand for a small rotary actuator for remote actuation of valves, shutters, controls, and similar applications. It is suitable for use with the Lear Magnetic DisKonnect Clutch on the output shaft, and with other variations and adaptations for remote positioning controls of preset or automatic types, "torque limiting clutch" arrangements, etc.

The standard unit does not include clutch or brake. However, a brake (without clutch) can be provided between motor and gear box for applications requiring accurate positioning. Because of low inertia of the small parts, a clutch at this point is not considered necessary.

Power is supplied by a Lear "G" frame motor of intermittent duty, split series or single-field type, incorporating in its electrical design output ratings varying from 0.4 to 15 watts at 24 volts d.c. Other windings can be arranged with shunt field for intermittent or continuous duty at 6, 12, or 24 volts. Special motors for higher voltage a.c. or d.c. or a.c.-d.c. combinations can be supplied. Four standard gear reductions are available. Lear, Incorporated, Grand Rapids, Mich.

Dual-Spiral Expansion Reamer

The principal change in the new design Dural-Spiral Expansion Reamer is a solid one-piece body all the way from the driving end to the lower lock nut. This one-piece construction considerably reduces the number of component parts. In addition, the manufacturer states that because of its increased rigidity, the cutting blades spiral even more concentrically than previously, and runout is held to a minimum, insuring accuracy to extremely close tolerances. Lempco Products, Inc., Bedford, Ohio.

Plane for Testing Wing Design

Details have been released about the Lightning Swordfish, a P-38 fighter converted into a "flying wind tunnel" for testing wing designs of superfighters and transports at speeds of more than 525 m.p.h. The Swordfish is distinguished by a 5-ft. yaw meter that protrudes from its nose to indicate skidding or slide slipping, an engineering observer's station back of the pilot's cockpit, superimposed wing sections covering outboard wings between nacelle and aileron, and rows of static tubes that trail the wings to measure airflow. It is fitted to test drag, lift, and airflow characteristics on any type airfoil under actual flying conditions.

Envelopes, or false wings, which cover a portion of the plane's regular wing, are constructed with airfoil contours in exact proportion to any experimental wing proposed. In flight the superimposed wing reacts to the plane's special instruments exactly as would a full-scale wing. Static tubes that indicate air pressures on instruments to measure airfoil drag are arranged behind each wing envelope in a pattern roughly resembling a large gardening rake. Other much smaller "rakes" can be moved across wing surfaces in flight to measure airflow. Pressure distribution through small holes in the wing envelope is used in calculating lift. Instruments in the plane's nose automatically recorded by a motion-picture camera, plus additional cockpit instruments for visual observation during flight, provide full records of each test made.

Although the Swordfish was originally developed to carry out dive tests on the P-38 Lightning, it has more recently tested proposed wings for planes ranging in size from fighters to large transports. Lockheed Aircraft Corporation.

Four-Way Control Valve

The "Modernair" four-way control valve, known as the Model CV Series, provides for the control of air and low-pressure hydraulic systems. The valves are adapted to hand, foot, or pilot operation by simple assembly changes of identical housings.

The CV Series valves are fully balanced, use aircraft-type packing, and are free from metal-to-metal contact between wearing parts. The design permits the transmission of full line volume and pressure through the valve, without the operation of the valve being affected by variation of line pressure.

The design of the valve permits its use normally "on" or "off" in three positions, the center position being "neutral." In the "neutral" position, when the valve is used for cylinder control, the unit may be arranged to permit positioning of the piston with pressure balanced on both sides of the piston, or with pressure relieved at both piston ends. Any of the adaptations as hand, foot, or pilot-operated valves can be used as a single three-way valve by plugging one outlet port, or as two three-way valves in series. When the unit is installed as two three-way valves in series, one valve will have the pressure on, while the other will have the pressure off.

Using the same assembly of housing, piston rod, and end plates, a hand-operated CV valve converts to foot operation by removing two clevis pins and replacing the hand lever with a foot treadle. Conversion of hand- or foot-operated valves to pilot operation involves the removal of one end plate and replacement of the piston and end plate. All of these changes may be made without breaking the line connections.

The valve is normally supplied with $^3/_8$-18 NPT female ports at 1 in. spacing on centers. The valve is also available in $^3/_4$-in.-18 port size, with other sizes contemplated for the near future. Mounting pads are $4^3/_8$ in. overall with $^9/_{32}$-in. diameter holes on $2^{13}/_{16}$-in. centers. Width of the valve body, port facing to port facing, is $3^1/_8$ in. Overall width of the valve body is $2^7/_{16}$ in. Modern Products Limited, Los Angeles.

Self-Contained Hydraulic Press

Hydraulic presses adaptable to all sizes and types of shops are available with self-contained motor drive for production work. They are made in capacities of $4^1/_2$, 7, 10, 15, 20, and 25 tons, with means to limit pressures as required. Pressure gages help determine pressures being applied, such as in laboratories, testing, etc. A holding valve may be ordered as an extra, enabling the press to be used for certain molding or glue-welding operations.

These presses are being used for operations such as push-broaching, forming, blanking, drawing, squeeze assembly of bushings, straightening, shot-pushing, and numerous other operations requiring positive, powerful push with minute control. Rams are interchangeable on the various presses, permitting greater speeds with lower-pressure rams or higher pressures at lower speeds, thereby giving the shop a wide range of production possibilities with the one press. Munton Manufacturing Company, Franklin Park, Ill.

Airplane Materials for Industrial Equipment

Northrop Gaines, Inc., a wholly owned subsidiary of Northrop Aircraft, Inc., is using airplane-fabricating tech-

niques in constructing hand trucks and industrial wheels of light metals.

The first item ready for the market will be industrial wheels cast of aluminum and with hard rubber tires molded on the wheels by a new process. These wheels, now being built in 6-, 8-, 10-, and 12-in. diameters, are designed for use on hand trucks, dollies, and all rollable industrial equipment.

Although they weigh as little as 3 lbs., the Northrop Gaines wheels are built to carry 40 per cent more weight than other wheels of equivalent size, and are equipped with Timken tapered bearings, which require no lubrication during the life of the wheel.

Northrop Gaines is also producing a line of hand trucks that have a frame cast in one piece of aluminum. The smallest of three sizes weighs only 36 lbs., yet has been stress-tested under a 5,000-lb. load. Large-size trucks have special clips on the side bars which permit the operator to handle a barrel without danger of its rolling off the truck accidentally. Northrop Aircraft, Inc.

Wire Brushes for Power Brushing

Situft power brushes for aircraft use utilize a new principle of wire suspension under pressure and are equipped with a variety of holding tools designed for use in drill presses, bench grinders, and special portable air and electric tools. They are made with special high-grade crimped wire ranging from 0.003 to 0.005 in.

Some of the advantages credited to the Situft brush are simplification and facilitation of the process of smoothing and cleaning drilled holes during the manufacture of aircraft engines; greater durability when used for the removal of burrs from threaded holes in aircraft rocker arms; efficiency in cleaning and polishing cavities in aircraft parts; and reduction of operating costs and time during the process of cleaning the inside walls of the ceramic barrel of aircraft spark plugs.

The brushes are available in numerous sizes. Outside diameters range from $^1/_4$ to $1^1/_4$ in.; brush face lengths from $^9/_{16}$ to $^5/_8$ in.; stem diameter from $^3/_{32}$ to $^1/_8$ in.; and overall length from $2^1/_8$ in. to $2^1/_4$ in. Their shipping weight ranges from 2 to $4^1/_2$ oz. The Osborn Manufacturing Company, Cleveland.

Profilometer Tracer

The range of surfaces on which roughness measurements can now be taken is increased by the introduction of the new Type AW profilometer tracer. Used in conjunction with the profilometer, the Type AW tracer is intended to augment the versatility, efficiency, and convenience with which profilometer measurements may be made.

The Type AW Tracer may be used to measure the roughness of surfaces on all outside diameters as well as on all inside diameters down to $^1/_4$ in. The tracer will also measure both internal and external tapered surfaces and gear teeth.

● No adaptations of the equipment are necessary to use the Type AW tracer with all types of profilometers now in use. Physicists Research Company, Ann Arbor, Mich.

Engineering Developments for Gliders

Several new developments applicable to the design, construction, and operation of gliders were demonstrated at the 3-day Motorless Flight Conference of the Soaring Society of America at the Polytechnic Institute of Brooklyn in October.

Presented as a possible answer to the long-felt need for a means of launching gliders, a ram jet engine was demonstrated in the form of a model 9 in. long and $2^1/_4$ in. in diameter. It contains no valves or moving parts. The small cylindric tube that appeared to be just an empty pipe, was mounted on a restraining structure which had a free moving arm to permit the engine to swing in a circle around it when in operation.

The lining of the tube tapers from the $1^1/_8$ in. diameter of the front end to $2^1/_4$ in. at the rear. The space between the lining and the outer wall contains the gas which runs into a nozzle at the forward opening of the cylinder. Air mixes with the gas coming through the small holes of the nozzle during combus-

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Good Performance • Dependability • Light Weight • Compactness • Appearance Appeal • Value Appeal • Low Maintenance

Probably no part of a motor-driven product has more influence on the design and operation features than the motor itself. That is why, in planning for the sharp sales competition that is ahead, more and more well-known manufacturers are turning to Lamb Electric motors.

Our 31 years' experience designing and building small motors may prove valuable to your engineering department.

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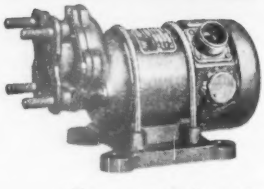
Typical applications for this motor: industrial vacuum cleaners, agitators, sirens and colloid mills.



Base-mounted, explosion-proof aircraft geared fuel transfer pump motor.

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tion, thus providing the force for operating the jet engine. It was stated that an engine of this type built for a two-place glider would be 40 in. long and 9 in. in diameter. Because it is a simple tube, the ram jet can be faired into the glider so that it has no drag and will not affect the aerodynamic efficiency of motorless aircraft. This engine, from the standpoint of glider use, is stated to be the simplest and the lightest engine so far developed. Another possible use is in slow aircraft.

Another development demonstrated was a new design for a Canard glider which utilizes an idea heretofore not applied in this connection and which the inventor believes provides a solution for the construction of tail-first aircraft. It uses a freely swiveling vertical tail surface provided with a linkage for the automatic setting of the tab, a device said to provide excellent lateral stability. Because of the device employed it may be possible to build planes with less wing area and utilizing less power, since the tail-first assembly may provide up to 5 per cent more lift.

By the use of all movable or free-floating tail surfaces the inherent difficulties of longitudinal and directional stability which have discouraged the development of the tail-first airplane are believed to be overcome. This solution, besides being effective, is also inexpensive, and in addition permits the pilot to select any degree of stability he desires, enabling him to take advantage of dynamic soaring. It is stated that the Canard design can easily be made stall proof.

Still another new invention for simplifying plane construction was presented by Dr. Nicholas J. Hoff, Associate Professor of Aeronautics at the Polytechnic Institute of Brooklyn. Dr. Hoff has developed what he calls a pseudo-framework fuselage, consisting of ring frames, longitudinals, and surface bracing elements. This pseudo-framework offsets the so-called drawbacks of welded steel-tube fuselages which have a greater drag because of the greater cross-sectional area, the less perfectly streamlined shape, and the less smooth surface.

Pseudo-framework is reported to be almost as simple and inexpensive to construct as welded-tube framework, while its streamlining is almost as good as that in the monocoque since it already has the correct shape. As compared with monocoque construction now widely used in gliders, with plywood as the material, the pseudo-framework is somewhat lighter and considerably cheaper. As a hybrid between the monocoque and the welded steel tube fuselage, pseudo-framework is expected to be useful to manufacturers in producing small-quantity orders for from ten to 100 planes.

Dr. Hoff explained that pseudo-framework is an improved framework composed of longitudinals and diagonals resistant to tension and compression, or to tension only, and transverse rings resistant to bending. It is covered with fabric except for minor sections where a metal or plywood covering is preferable for reasons of local strength or smoothness. Pseudo-framework contains, in comparison with monocoques, a smaller number of structural elements, which, because it has no stressed-skin covering, has a higher average allowable stress and, therefore, a smaller weight.

It is stated that because of the small number of elements and other simple attachments, and also because of the absence of the sheet covering which in monocoques necessitates much work in shaping and riveting, the pseudo-framework can be built in a greatly reduced number of man-hours. Its manufacture requires few tools, fixtures, and jigs. It can be built of steel tubes and steel bands and therefore its manufacture does not depend upon the availability of aluminum alloys. Polytechnic Institute of Brooklyn.

Air-Travel Films

Three travel films, in color, have just been completed. Planned to stimulate public interest in various areas served by the Pan American Airways System, the new motion pictures deal respectively with Alaska, Bermuda, and Latin America. Early release of the subjects to audiences throughout the nation is planned. The Princeton Film Center, Princeton, N.J.

Heavy-Duty Voltage Regulators for Low Voltage D.C. Generators

Improved three-unit, vibrating type, heavy-duty voltage regulators for low-voltage d.c. generator application are now being produced. Compactly designed and sturdily constructed, these regulators are recommended by the manufacturer as being especially suitable for stationary or mobile gas-engine or motor-driven generators. All three units (reverse current relay, voltage control, and current limiter) are designed to work in any position and to withstand external vibration and shock normally encountered in mobile apparatus. The complete assembly is sealed in a gasketed, drawn-steel enclosure—dust-tight and waterproof.

These voltage regulators are available in maximum capacities of 30 amp. at 6 to 32 volts and 45 amp. at 6 to 12 volts d.c. Maximum field current rating is 3 amp. at 6 volts; 0.5 amp. at 32 volts d.c. Approximate dimensions are width, 7¼ in.; depth, 4 in.; height, 3½ in. Average weight is 3.25 lbs. R-B-M Manufacturing Company, Division of Essex Wire Corporation, Logansport, Ind.

Two-Way Radio for Private Airplanes

The Ranger Model 116 receiver and Model 209 transmitter are operated in combination to provide the private flier with dependable long-range, two-way communication.

The Model 116 receiver is a five-tube superheterodyne with automatic volume control, range filter, and high sensitivity and selectivity. It covers the 195–410 kc. band for range, weather, and tower communication. The Model 116 is powered by the 12-volt power supply in the transmitter and serves as the control unit for the transmitter. It mounts on the instrument panel in a standard 3 in. hole; its weight is 2 lbs. 11 oz.

The Model 209 transmitter is a single-frequency, crystal-controlled transmitter of new design. It is built to provide long-range contact with a fixed antenna. Consequently, no pilot-tuning of the transmitter is necessary—it is tuned when installed and thereafter operates at maximum output without further adjustment. It may be mounted under the seat, in the luggage compartment, or in any other convenient place. The Model 209 as regularly furnished transmits on 6,210 kc. Optional frequencies between 1,500 kc. and 14,000 kc. also may be supplied. It weighs 13 lbs. 2 oz. Ranger Aircraft Radio Division of Electronic Specialty Company, Los Angeles.

Surplus Radio and Electronic Devices Available

Radio direction-finder units, two-way ground-to-plane and plane-to-plane communications sets, plane interphone equipment, plane-to-ground telephones and a variety of other radio and electronics material no longer needed by the armed forces are now being offered for use in the nation's commercial and private planes.

The equipment is being distributed by more than 225 radio and electronics manufacturers who have been appointed disposal agents by the Reconstruction Finance Corporation. According to estimates, many millions of dollars in new and used electronics and radio-communications equipment suitable for air uses will be disposed of by these manufacturer-agents.

It is anticipated that the program will effectively enlarge the markets of the radio and electronics industry, create new fields for its products, and control the increasing flow of the materials into civilian channels. A substantial portion of the original cost of the equipment will thus be regained by the American taxpayer.

Prices for the equipment will be based on new-equipment prices for electrically and mechanically perfect and unmarred units, slight reductions for electrically and mechanically perfect but marred parts, and further reductions for electrically and mechanically perfect but battered parts. Reconstruction Finance Corporation.

The Republic Rainbow

Details of a program for the production of the Republic RC-2 Rainbow have been completed with Pan American World Airways. The new Clippers will be designed to fly from New York to London in 9 hours and from New York to Los Angeles in about 6 hours. Delivery of the first six planes now on order by Pan American is expected to start within 22 months.

Continental Air Lines

9 MILLION MILES
4 MILLION GALLONS!

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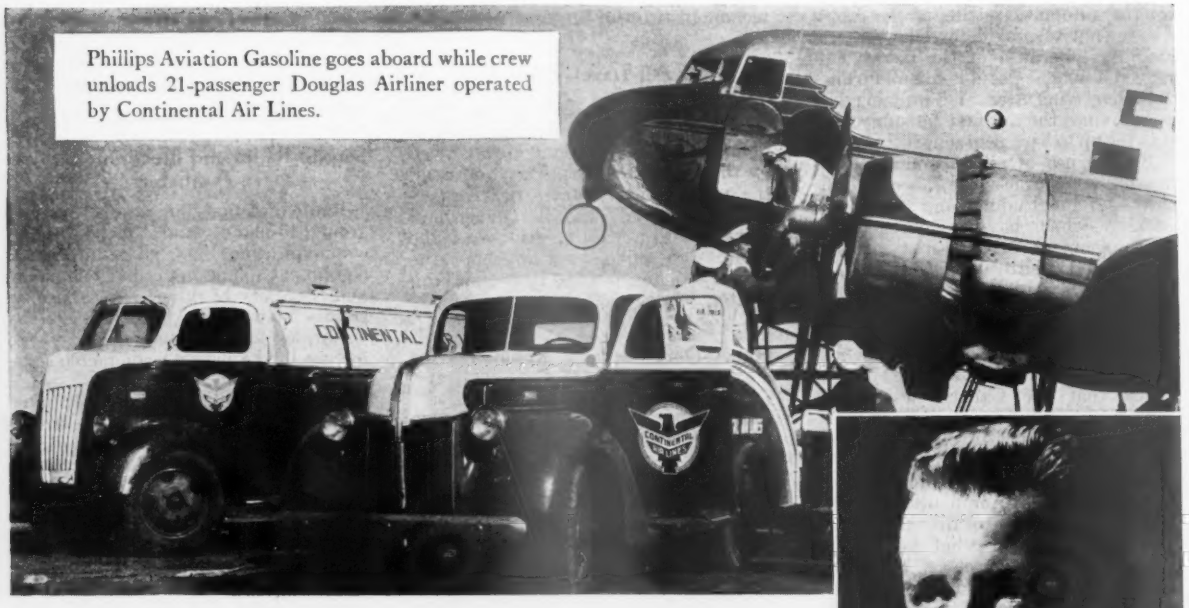


Phillips Aviation Gasoline goes aboard while crew unloads 21-passenger Douglas Airliner operated by Continental Air Lines.

Robert F. Six, President of Continental Air Lines, is America's youngest airline president.

For an industry which has had a rate of growth greater than Paul Bunyan's, Continental is still a stand-out!

Just eleven years old this past summer, Continental showed a 1-year increase of 121% in revenue passenger-miles flown in 1945.

We're interested in this figure because we played a part in helping create it. Over the past 4½ years Continental has flown over 9 million Phillips-powered miles—consumed 4 million gallons of Phillips Aviation Gasoline!

Now that's a pretty good record—for Continental *and* us. But what is more important, we think, is the satisfaction and good-will we've built at Continental.

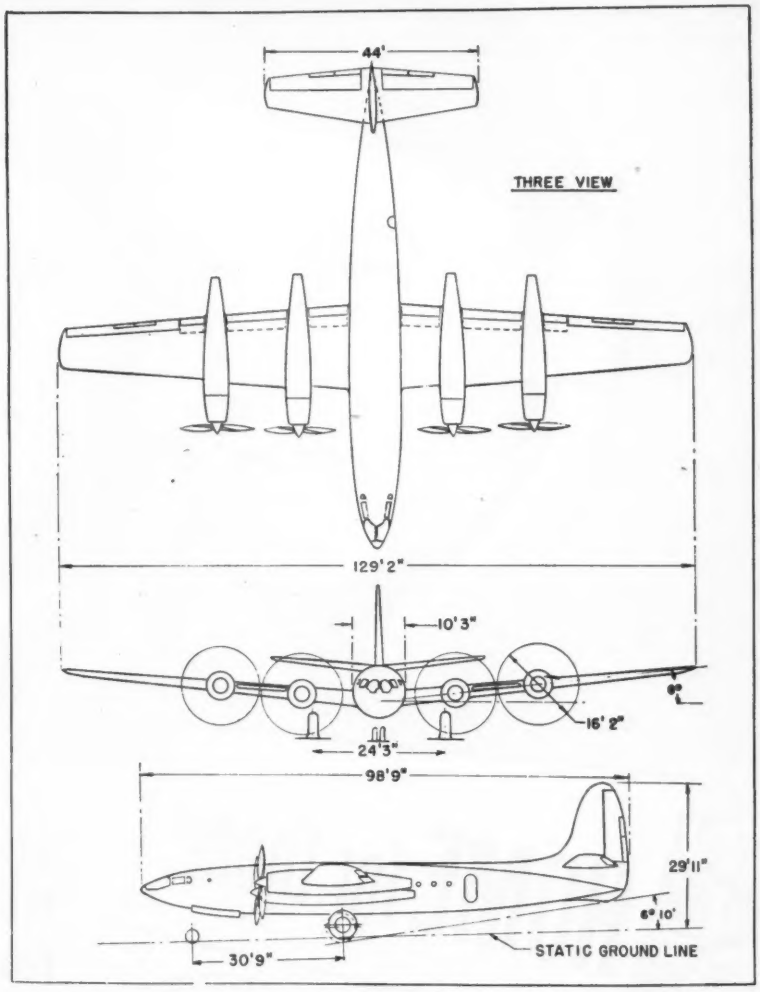
This is an advertisement for our Aviation Gasoline. And we think the best tip-off on *any* product is the kind of folks who use it. Ask *them* about Phillips products and Phillips Service. Or ask us. Just write to the Aviation Department, Phillips Petroleum Company, Bartlesville, Oklahoma.

Phillips
AVIATION GASOLINE

With a cylindric fuselage fully pressurized for flying in the stratosphere, passengers will travel in air-conditioned cabins at 40,000-ft. cruising levels. Equipped for long transcontinental and transoceanic schedules, the new Clippers will have accommodations for 40 passengers and crew, in addition to mail and other cargo.

Just short of 100 ft. in length, with a wing span of 129 ft., the Rainbow will have a gross weight of 113,250 lbs. It will be powered by four turbosupercharged Pratt & Whitney Wasp Major engines producing over 3,000 hp. each, utilizing the thrust of the exhaust jet.

The principal specifications are as follows: span, 129 ft. 2 in.; length, 98 ft. 9 in.; overall height, 29 ft. 11 in.; maximum fuselage diameter, 10 ft. 3 in.; wing area, 1,640 sq.ft.; weight empty, 66,980 lbs.; take-off gross weight, 113,250 lbs.; pay load for 4,150-mile range, 10,000 lbs.; passenger capacity, 40; crew number, 7; cargo capacity, 1,200 lbs.; fuel capacity, 5,570 gal.; engines, four Pratt & Whitney Wasp Majors, take-off power, 3,250 b.hp. each; high speed at 40,000 ft., 450 m.p.h.; cruising speed at 40,000 ft., over 400 m.p.h.; rate of climb at sea level, 1,680 ft. per min.; rate of climb on two engines at 5,000 ft., 320 ft. per min.; range (with no reserve), 4,150 miles; service ceiling, 41,000 ft.; take-off distance over 50 ft. obstacle, 4,300 ft.; landing distance over 50 ft. obstacle, 3,000 ft.; stalling speed, 95 m.p.h. Republic Aviation Corporation.



A three-view drawing of the Republic Aviation Corporation's 40-passenger Rainbow.

Republic XP-47J Thunderbolt

It has recently been announced, with War Department authorization, that an experimental model of the P-47 Thunderbolt—known as the "J" type—was flown at a speed in excess of 500 m.p.h. on August 4, 1944. Powered by a Pratt & Whitney R-2800-C Double Wasp engine and driven by a Curtiss-Wright electric experimental propeller, with a special 2-in. hand-welded trailing edge, the J-type Thunderbolt was the only one of its class to be built.

In outward appearance, the XP-47J was similar to the P-47D airplanes which had been built up to that time. It was designed and manufactured to meet specific requirements for an intercepter-type fighter with a high rate of climb and great speed.

In addition to the Double Wasp engine, the power-plant installation included a General Electric CH-3 turbosupercharger. This gave the pilot, under war-emergency conditions, approximately 2,800 hp. at a pressure altitude of 34,000 ft.

Air-intake ducts and engine cowling were redesigned and an engine-cooling fan was incorporated, built like a turbine wheel and driven directly by the propeller. The turbosupercharger installation was so mounted as to eject exhaust gas directly in the line of flight, thus providing approximately 400 hp. of thrust assistance to the engine. After Republic tests had been run, the XP-47J was turned over to the A.A.F. test base at Wright Field, where continuing flight tests over a period of 8 or 9 months substantiated the performance findings recorded by the builder's pilots and flight-test engineers. Republic Aviation Corporation.

Automatic Piston-Ring Inspection Device

A gaging machine for the automatic checking of piston rings offers to makers of aircraft engines the means of rapidly checking incoming piston rings during receiving inspection.

With methods now in use piston rings are inspected by hand for proper width of gap and trueness of periphery. In most cases hand inspection is slow and costly, while the rings vary and some that should be rejected pass inspection.

The makers state that with the Sheffield Automatic Piston Ring Inspector (see photograph on page 139), inspection of the gap and periphery is much more accurate and less expensive than sample checking by hand. Uniform quality of accepted parts is assured. Salvageable rings are positively classified so that rework costs are lowered. Rejected rings are known to be below acceptable standards.

The machine segregates the piston rings into three groups: (1) acceptable periphery and gap, (2) reject gap, and (3) reject periphery because of failure to meet requirements. The entire checking and separating operation is done automatically, the operator having but to load the rings into the feeding device.

If the ring is a reject because of either periphery or gap, selector shutters permit the ring to fall by gravity into the reject stations on the sides of the machine. A spring-loaded clutch throws the driving mechanism out of gear should the machine jam because of piston rings being laced together while loading into the feeding mechanism. The Sheffield Corporation, Dayton, Ohio.

Great Britain's First Postwar Tailless Aircraft

Great Britain's first postwar tailless aircraft, designed and built by Handley Page, is now flying. This type, em-

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You still have time! In December, your employees' allotments to the Victory Loan through your company's Payroll Savings Plan offer a final chance to help speed the proud homecoming of our fighting men—and do all in medical power for our hospitalized heroes!

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Resolicit every employee to buy the New F.D.R. Memorial $200 Bond

The new Franklin Delano Roosevelt $200 Bond—better than actual cash because it earns interest—is a strong building stone toward the secure future of every employee-purchaser!

From now 'til the New Year—with plant rallies, interdepartmental contests and resolicitation—keep Payroll Savings Plan Bond-buying at a new Victory Loan high! Buying a Victory Bond is the best way of saying "Welcome Home" to our returning veterans! Also an active aid in assuring prosperity to your nation, your employees—and your own industry!

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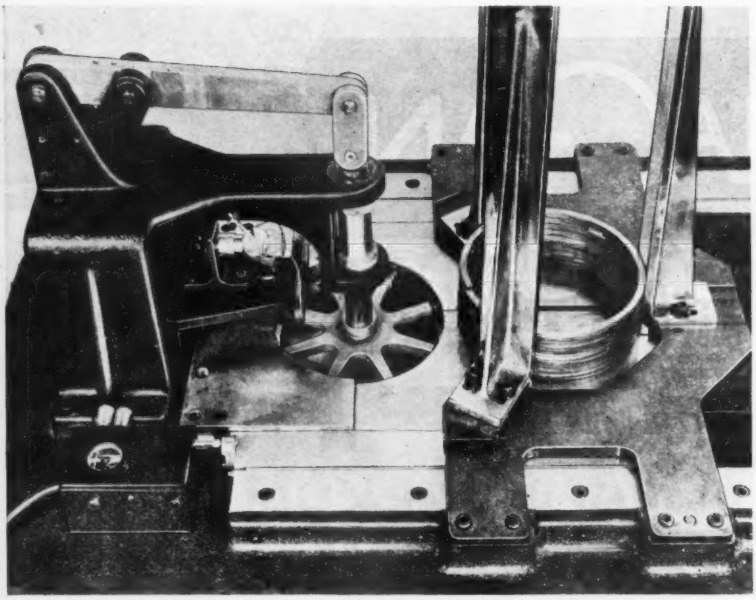

The top of the Sheffield Corporation's piston-ring gaging machine showing some of the mechanism.

bodying the principle of the flying wing, and named the Manx, is powered by two de Havilland Gipsy Major engines of 140 hp. each. It weighs 4,000 lbs., has a wing span of 40 ft., wing area of 246 sq.ft., and a fuselage length of 18 ft. Accommodation is provided for a pilot and one passenger. The aircraft cruises at 150 m.p.h. and its ceiling is about 15,000 ft.

The Manx contrasts sharply with the conventional airplane, the wings being swept back at an acute angle, with rudders that move in an outboard direction only, mounted at the tips. The ailerons also act as elevators and are known as "elevons."

The main advantages claimed for the tailless type of aircraft are lower structural weight because there are no tail surfaces to be carried, the unrestricted field of fire aft in the case of a military airplane, and easy access for loading both freight and passengers through the rear ends of the fuselage in the case of a civil type. Such a type offers possibilities for the installation of jet propulsive units within the wings. The Society of British Aircraft Constructors, Ltd.

New British Aircraft

Eleven formerly secret British naval warplanes, all equipped for operation from aircraft carriers, were shown for the first time at a display staged by the Admiralty. Some were derivatives of military landplanes made famous by the R.A.F. during the war; the others were exclusively naval in conception.

The Sea Hornet, a twin-engined fighter, has a speed well in excess of 450 m.p.h., and a range, with overload tanks, of more than 2,000 miles. The Monitor II is a high-speed fleet target tower, faster than its predecessor in this role by nearly 150 m.p.h.

Four different versions of the Seafire (the naval equivalent of the Spitfire) were shown. They were the Marks III, 45, 46, and 47. The last three are adaptations of the R.A.F. Spitfire Marks 21 and 22—the last of the long line of this single-engined fighter. The Sea Fury was originally intended to be an improved Tempest II, but was largely redesigned for naval duties and might almost be regarded as a purely naval fighter.

The Seafang is a naval counterpart of the Spitfire's successor, the Spiteful. Its speed is well above 460 m.p.h. The conversion of the Mosquito fo. aircraft-carrier duty is another evidence of this warplane's record of versatility. With the R.A.F. it has been used for almost every purpose from bombing with 4,000-lb. bombs to antisubmarine work with a 6-pounder field gun. The Sea Mosquito, it is believed, made history a year ago when it landed on the deck of an aircraft carrier during trials to test its suitability for naval work.

Few could have expected the Vampire to be suitable for carrier operation. Jet-propelled aircraft normally have a poor take-off, but the Vampire's de Havilland Goblin gas-turbine engine gives powerful thrust at comparatively low altitude as well as at great height, and experiments have satisfied the authorities that the R.A.F.'s latest single-engined jet-propelled fighter is capable of becoming air-borne within the restricted length of a carrier's deck under all active service conditions.

New versions of earlier naval aircraft were also featured in the flying display. Among them were the Firebrand TF Mark IV (a single-engined "strike" aircraft designed and built by Blackburn Aircraft), the Fairey Barracuda V single-engined torpedo bomber, and the Fairey Firefly IV, single-engined, two-seater fighter.

One naval aircraft shown and flown had not previously been mentioned publicly. This is the Fairey Spearfish, a single-engined, all-metal, midwing torpedo drive bomber with the specially boosted Bristol Centaurus 57 air-cooled, 18-cylinder, sleeve-valve radial engine developing 2,585 hp. and driving a five-bladed Rotol constant-speed propeller. The Spearfish has a maximum range of 900 sea miles and its maximum speed is 292 m.p.h. at 14,000 ft. It is flown by a crew of two, and can also be

The de Havilland Vampire. This jet-driven interceptor fighter uses the de Havilland Goblin turbine and has a top speed exceeding 500 m.p.h.

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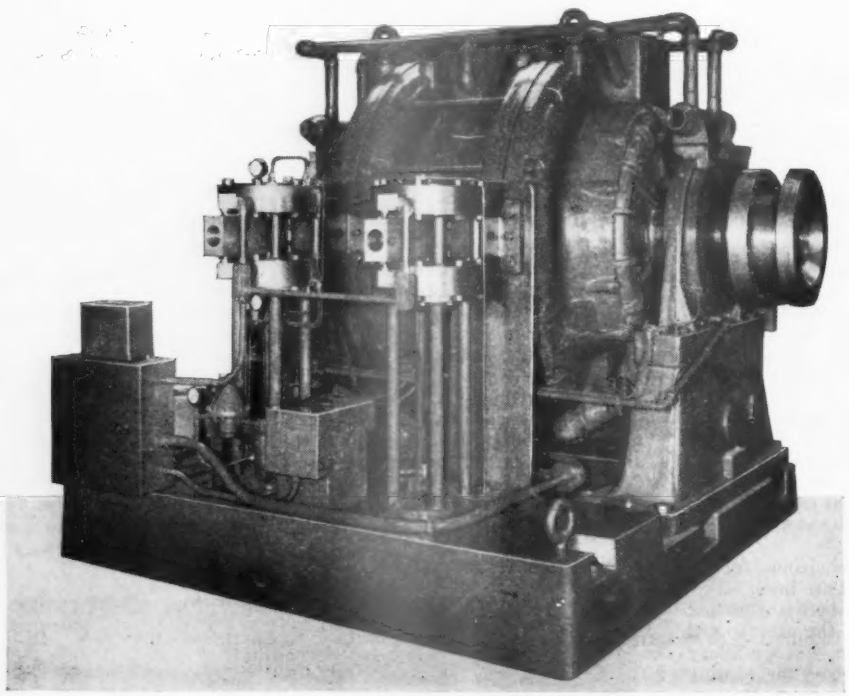

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used for scouting and antisubmarine duties. Torpedoes and bombs are carried internally in a bomb bay in the fuselage. Radio and radar devices are included in its equipment.

Weighing 24,000 lbs. when loaded, the Spearfish has a wing span of 60 ft.; its length is 45 ft. 4 in., its height 16 ft. 6 in., and its wing area 530 sq.ft. Its armament consists of two 0.5-in. fixed forward-firing machine-guns, and two 0.5-in. machine guns in a Nash and Thompson power-operated turret aft.

None of the aircraft taking part in the display had reached operational status, but production is going forward as fast as circumstances permit and all are expected to be in service in 1946.

Another secret British type made public recently is the all-metal Bristol Buckmaster, which is claimed to be the world's first high-powered advanced trainer. Its two Bristol Centaurus VII air-cooled, sleeve-valve radial engines deliver a total of more than 5,000 hp. at take-off, and at 12,000 ft. the Buckmaster can reach a speed of 352 m.p.h. in level flight.

Until this new design went into service, pilots of fast British twin-engined fighters had no suitable aircraft on which to train. In the trainer version of the Beaufighter, for instance, the instructor sat behind the pupil and had little or no control over the aircraft. In the Buckmaster, pupil and pilot sit side-by-side and the pupil's mistakes can be instantly corrected by the instructor should circumstances demand. The Buckmaster is equipped for night flying, has a full set of "blind-flying" instruments and by virtue of its long range can be used for navigational training.

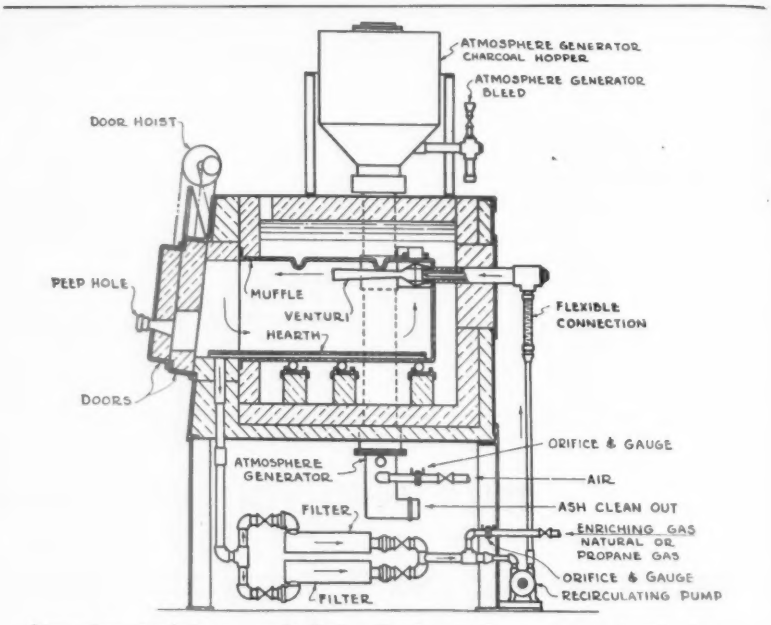
Its dimensions are: span, 71 ft. 10 in.; length, 46 ft. 5 in.; height, 17 ft. 3 in.; track, 20 ft. Fully loaded, the new trainer weighs 33,700 lbs. Its cruising speed is 325 m.p.h. at 18,000 ft.; its initial rate of climb is 2,245 ft. per min. and its service ceiling 30,000 ft. The Society of British Aircraft Constructors, Ltd.

Complete 16-Mm. Film on "Swaging"

An informative motion-picture film on the subject of "Swaging" is now available to educational, employer, and employee groups. This 16-mm. film with sound commentary has been prepared in English, French, Russian, and Spanish for preliminary distribution. Its 26-min. run gives a portrayal of the many applications of the swaging process in today's production methods for pointing, shaping, and attaching fittings to bar, cable, and tube. Steel (including stainless), copper, aluminum, and even wood products are shown by the film to be included within the processing scope of the swager and its derivatives. Standard Machinery Company, Providence, R.I.

Dual-Purpose Furnace

For increased flexibility in handling different batch-type heat-treating operations, a new atmosphere-muffle furnace is now offered. Because of a new feature of design, the furnace can produce the proper atmosphere for gas carburizing and also is applicable for general heat-treating.



Atmosphere circulating system for Surface Combustion Corporation's carburizing furnace.

After producing the basic atmosphere, the furnace utilizes a new gas-enriching and recirculating system for gas carburizing. Instead of circulating all the gas in the muffler through the enriching system, thus tending to cool the entire amount, only about 10 per cent is removed from the muffle at any time. This gas is continuously withdrawn near the door and is first filtered to remove any free carbon that may have dissociated from the carbon monoxide in the atmosphere. After filtering the atmosphere gas, the enriching gas (raw material gas or propane) is added through a metering orifice. The gas then passes to the recirculating pump, which is of the positive displacement (vane) type. The gas under pressure is discharged at high velocity into a venturi within the muffle, inspirating into the venturi a large volume of muffle gases. These are mixed in the venturi and are discharged to recirculate throughout the muffle.

Indicative of the flexibility of the unit, conversion from a carburizing to a heat-treating atmosphere, and vice versa, can be quickly made without shutting down. For rapid heating, the furnace is equipped with overmuffle and undermuffle burners. The rapid rate of carburization obtainable is indicated by the results on SAE 1020 steel, for which the time at temperature of 1,700°F. to obtain a case depth of 0.020 in. is 1 hour, and for 0.070-in. is 7 hours.

The furnace utilizes a selective double door to facilitate handling pieces of various sizes with least loss of atmosphere. The inner door has a small opening for the insertion and removal of small pieces, and both doors may be opened for large pieces. Both doors are of air-lift type, operated by a tilting treadle with manual selector. The control panel is mounted at eye level on the furnace shell to the left of the door. Two flowmeters are regularly supplied, one for air to the generator, the second giving the flow of carburizing (enriching) gas. The charcoal container is mounted on top of the Char-Mo gas generator which is built into the furnace.

The basic atmosphere gas for the furnace is made by reacting carbon (charcoal) with air in a generator built into the furnace so that the gas is formed at furnace temperature. A small portion of the generated gas thus formed is bled from the hopper to eliminate from the charcoal all moisture and volatile products before it is used to generate the atmosphere gas which is introduced into the muffle. Filters are at floor level, easily accessible for cleaning. The furnace is avilable in three sizes, for light-or medium-batch operations. Surface Combustion Corporation, Toledo.

Light-Plane Controls

A line of controls used in military aircraft has been adapted for use in light planes. Cable and conduit are identical with those employed for the military types, but simple end fittings, forming an integral part of the cable itself, eliminate the relatively expensive types of push-pull controls and complicated forms of swivel couplings or other attachments at the remote end.

At the control end, the conduit itself forms the body of the push-pull unit and the so-called inner slider is actually

the cable itself which takes the form, at this point, of a rigid rod to which the push-pull knob or handle is directly attached. At the remote end, the cable again takes the form of a conventional rod end to which any standard fitting may be attached.

Because of the nature of the cable used, it is possible to provide a rod end with any desired degree of rigidity, and the manner in which this is formed precludes the possibility of failure at point of attachment.

This type of control is said to be especially suitable for throttles, propeller-pitch, trim tabs, and similar controls. Teleflex Incorporated, Philadelphia.

Video Amlpifier

A new Video Amplifier is designed primarily for use in amplifying complex waves to be viewed on an oscilloscope. The amplifier is also useful in laboratory work as an audio amplifier, for tracing and measuring small R.F. Voltages (as in the early stages of radio receivers), and many similar applications.

The frequency response is flat within 1.5 db. of the 10 kc. response from 15 cycles to 4 megacycles, and 3 db. from 10 cycles to 4.5 megacycles. The phase shift is reduced to a minimum to provide satisfactory reproduction of pulses on the order of one microsec., and square waves at repetition rates as low as 100 per sec.

The gain is approximately 1,000 when direct input is used. Input is normally through a probe, furnished with the equipment, having an attenuation of 10 times. The amplifier direct input (without probe) is approximately 2.2 megohms of resistance in parallel with 40 mmfd. This compares with 1.1 megohm resistance in parallel with approximately 18 mmfd. when the probe is used. The output voltage can be adjusted from zero to 50 volts r.m.s. with sine wave signals. The ripple output is less than 0.5 volt for all operating conditions and all positions of gain control. The amplifier operates on a voltage of 110 to 120 volts, 60 cycles with a power consumption of 100 watts. A compact unit, it weighs 35 lbs., complete with tubes and probe, and occupies a space of $7^3/_4$ in. by 9 in. by $20^3/_4$ in. United Cinephone Corporation, Torrington, Conn.

Horizontal Milling Machine

The No. 2 heavy Van Normal milling machine is especially adaptable for a wide range of production and general-purpose milling applications. It is stated that many new engineering features have been added to make contributions to faster, easier, and more accurate operation.

The new column and base is heavier and larger, with internal ribbing to assure ridigity for the heavy-duty spindle, spindle transmission, and knee. An important feature included in the new design is a heavy, large-diameter flywheel mounted on the inside of the column, assuring smooth, uniform application of power to the cutter.

The cutter spindle is large in diameter and is mounted on double-opposed Timken bearings in the center and straight roller bearing in the rear. The new spindle transmission incorporates wide-face hardened alloy-steel gears mounted on multisplined shafts rotating on taper roller bearings.

Front and rear directional control of all power feeds, actuated in the direction of desired movement, permits operation of the miller from front or rear position. Manual feeds are provided in both front and rear of the miller. Single-lever speed and feed selectors provide quick, easy selection of 18 speeds and 18 feeds.

The improved ram-type overarm is large and has a dovetail bearing on the column, with locking means on front and rear of the column. A pilot wheel enables the operator to place the overarm in any desired position. Other features include a conveniently located spindle-operator lever which is easily positioned for front or rear operation, safety devices in the knee to eliminate strain on any unit of the mechanism should any feed overload occur, large-diameter feed screw, automatic lubrication, hardened alloy-steel gears and shafts, large dials graduated in thousandths, and multisplined shafts operating on antifriction bearings.

The new miller has a table measuring 58 in. by 13 in. Drive motor is $7\text{-}^1/_2$ hp. Longitudinal range is 28 in., cross 10 in., and vertical 17 in. Speeds are available from 30 to 1,500 r.p.m., and feeds from $^3/_8$ in. to 32 in. The miller is built with plain or universal saddle. The universal saddle permits the table to be swiveled 45° to the right and 45° to the left. Van Norman Company, Springfield, Mass.

Hole-Punchers for $^1/_4$-in. Metal

Heavy-duty Type "BJ" hole punching units are designed to pierce metal up to $^1/_4$-in. thick. Each unit consists of a holder that carries the punch, die, and stripping mechanism. The patented design eliminates the necessity for attaching punch to press ram and assures permanent alignment of punch and die.

Reducing perforating diemaking to a simple assembly job, these units release experienced diemakers and die setters to work on more complicated dies because any good mechanic may assemble them into a hole-punching die for operating in stamping presses or press brakes. Setups are made on T-slotted plates or templates for stamping presses and on rails for press brakes. The setup is placed in the press and it is ready to start punching with the first stroke of the press without further adjustment of units or punches and dies. The press ram requires only one adjustment regardless of how many hole-punching patterns are placed in operation because of the uniform shut height of the units. These advantages reduce press "down time" between setups to an absolute minimum. Type "BJ" is available in three holder widths with maximum punch diameter of $^3/_4$ in. for use with metal up to $^1/_4$-in. thick. Wales-Strippit Corporation, North Tonawanda, N.Y.

Induction and Dielectric Heating Data Sheets

The physical constants of metals are given in a data sheet for the use of those who are interested in the application of radio-frequency heating. It gives the resistivity, the temperature coefficient, the specific gravity, the specific heat, and the thermal coefficient of a group of 34 metals. The figures are applicable at a temperature of 20°C. unless otherwise specified. Westinghouse Electric Corporation, Industrial Electronics Division.

Rivet-Shaving Cutter

A new rivet-shaving cutter has been developed to fit the manufacturer's standard micrometer-stop countersink drive, as well as standard rivet-shaving machines.

Tests on this cutter are reported to show that the average useful life is from 18 to 20 hours, in comparison with 6 to 10 hours for ordinary high-speed types. The Zephyr cutter is made of 18–4–1 steel and is electrolized to provide a surface hardness of approximately C-82. The makers also manufacture a similar cutter with tungsten-carbide tips on which the average use is from 36 to 40 hours according to recent field tests. Zephyr Manufacturing Company, Inglewood, Calif.

Changes of Address

To facilitate the prompt receipt of copies of the JOURNAL and REVIEW, members and subscribers are requested to give the editorial offices 30 days' notice of any change of address.

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STRAIGHT-LINE FORCE!

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ASSEMBLY NO.	BORE (Inches)	STROKE (Inches)	PORT SIZE (Inches)
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354	7/8	7-3/4	1/2-20
351	1	21-15/16	1/2-20
348	1-1/16	16-1/2	1/2 P.T.
169-AN	1-1/8	4-3/4	7/16-20
166-AN	1-3/8	10	7/16-20
129-R-AN	1-1/2	1-1/4	7/16-20
335	1-5/8	3-13/32	7/16-20
329	1-3/4	5-3/32	7/16-20
364	2	1	1/8 P.T.
128-1-AN	2-1/8	9-5/32	9/16-18
102-AN	2-1/4	4-5/16	7/16-20
200	2-3/8	9-3/4	9/16-18
127-AN	2-1/2	7-1/8	9/16-18
296	2-3/4	15-3/4	9/16-18
188	3	9-1/32	9/16-20
107	4-1/2	10-3/4	9/16-20

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Important Announcement

The Officers and Council of the Institute of the Aeronautical Sciences are pleased to announce that the *Journal of the Aeronautical Sciences* will resume publication as a monthly commencing in January, 1946. This change has been made possible because of the relaxation of restrictions controlling the use of paper. There will be no change in subscription rates.

An Appreciation

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They enable the Institute to publish scientific and technical papers in the *Journal* and to devote its pages exclusively to editorial material.

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IN a recent engagement against Jap-occupied *Iwo Jima*, a KINGFISHER Observation Scout Seaplane (OS2U) had been catapulted off a United States cruiser to direct Naval gunfire.

Circling over the island in full view of an enemy airfield, Lieutenant Robert W. Hendershott, U.S.N.R., of Bend, Oregon, pilot of the lightly armed little float plane, calmly proceeded to fulfill his hazardous but vitally important mission.

The slow-cruising Kingfisher looked like an easy mark to the Nip's nest of Zero fighters. Hardly had the surface vessels begun their bombardment, when Hendershott's Observer, Arthur E. Hickman, Aviation Radioman, second class, U.S.N.R., of Denver, Colorado, spotted three Zeros spiralling up.

Rapidly gaining altitude, the enemy planes opened fire on the Kingfisher from below. The lead attacker made a stern approach. Hickman, crouching over his light machine gun, coolly bided his time, and as the fast, heavily armed Zero came within range, let go with a perfectly aimed burst into its engine.

Hickman's bullets must have killed the Jap pilot. For the Zero roared on in—sheared off the Kingfisher's starboard wing tip—and crashed into the sea.

The second Zero came on. Its bullets ripped through the Kingfisher's fuselage within inches of the Navy pilot's legs. The oil tank was punctured. Hot oil spurted over the windshield and cockpit.

Again and again, the two fast and highly maneuverable Jap fighters slammed at the crippled Kingfisher. The fuselage was completely riddled. Finally, Pilot Hendershott maneuvered his plane within reach of the protecting screen of U. S. destroyers and cruisers—and the Jap fliers pulled away!

Score: One Edo float equipped Navy Seaplane damaged. One latest-type Zero knocked into the sea. Two other Zeros badly baffled by a non-combatant observation plane manned by two very combat-minded Navy men. The Japs should file a complaint!

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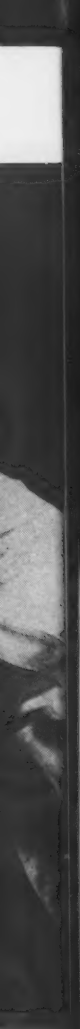

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